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July

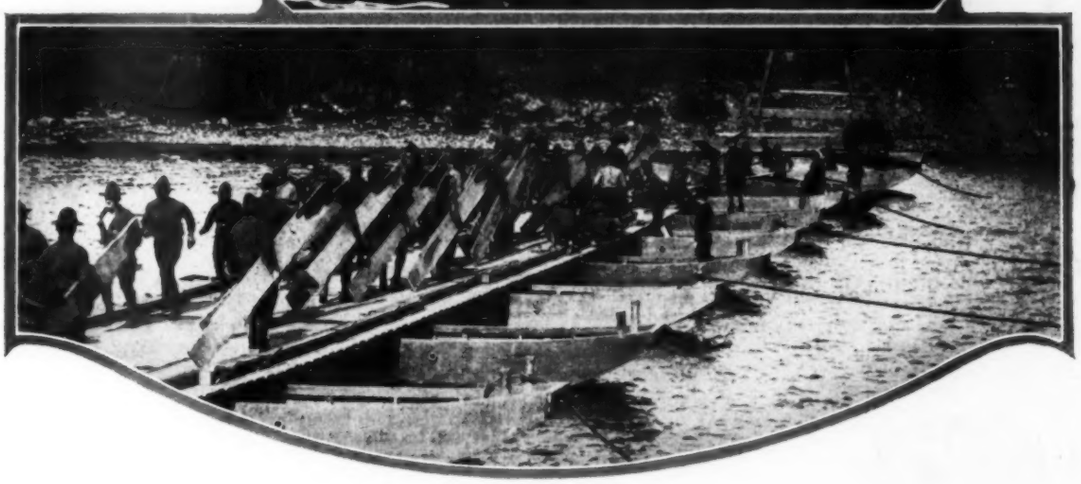
1918

MOTOR BOATING

Scientific Mechanics

Air Boating

Vol. XXII, No. 1



American engineers building a pontoon bridge 350 feet long in forty minutes

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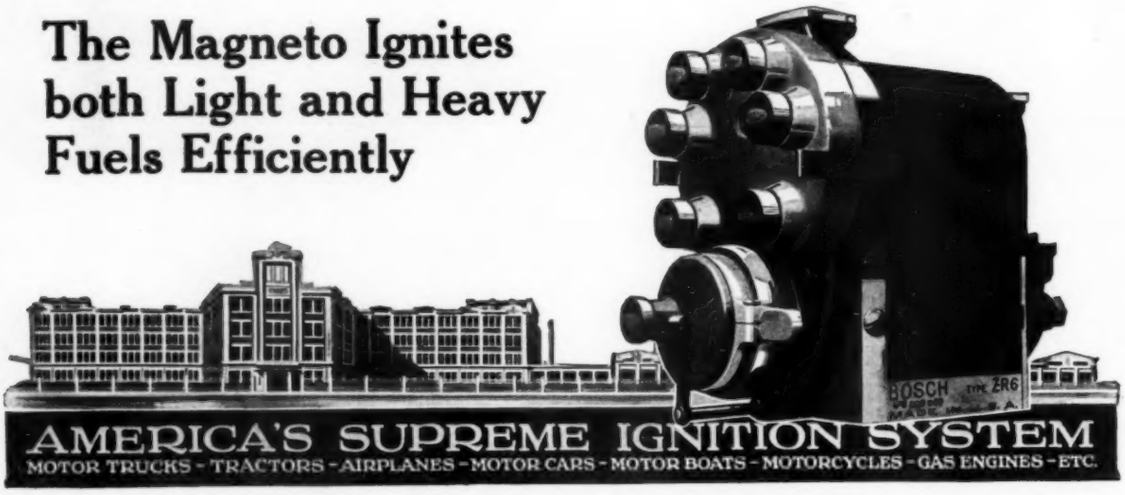

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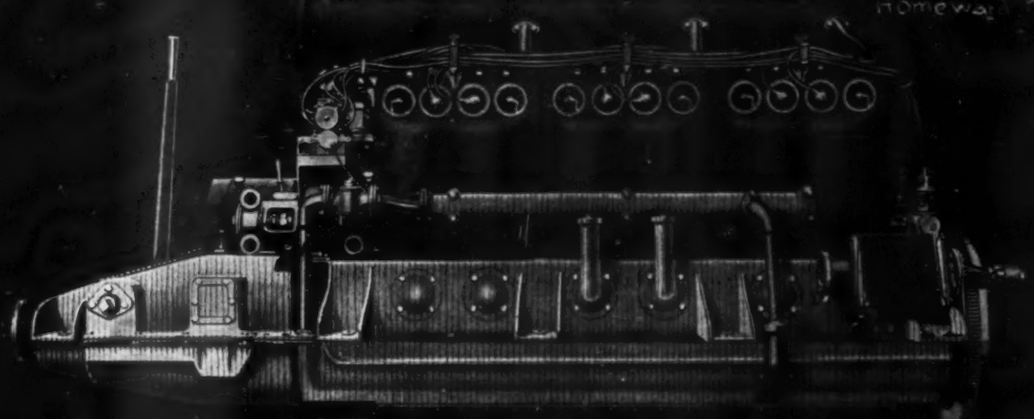

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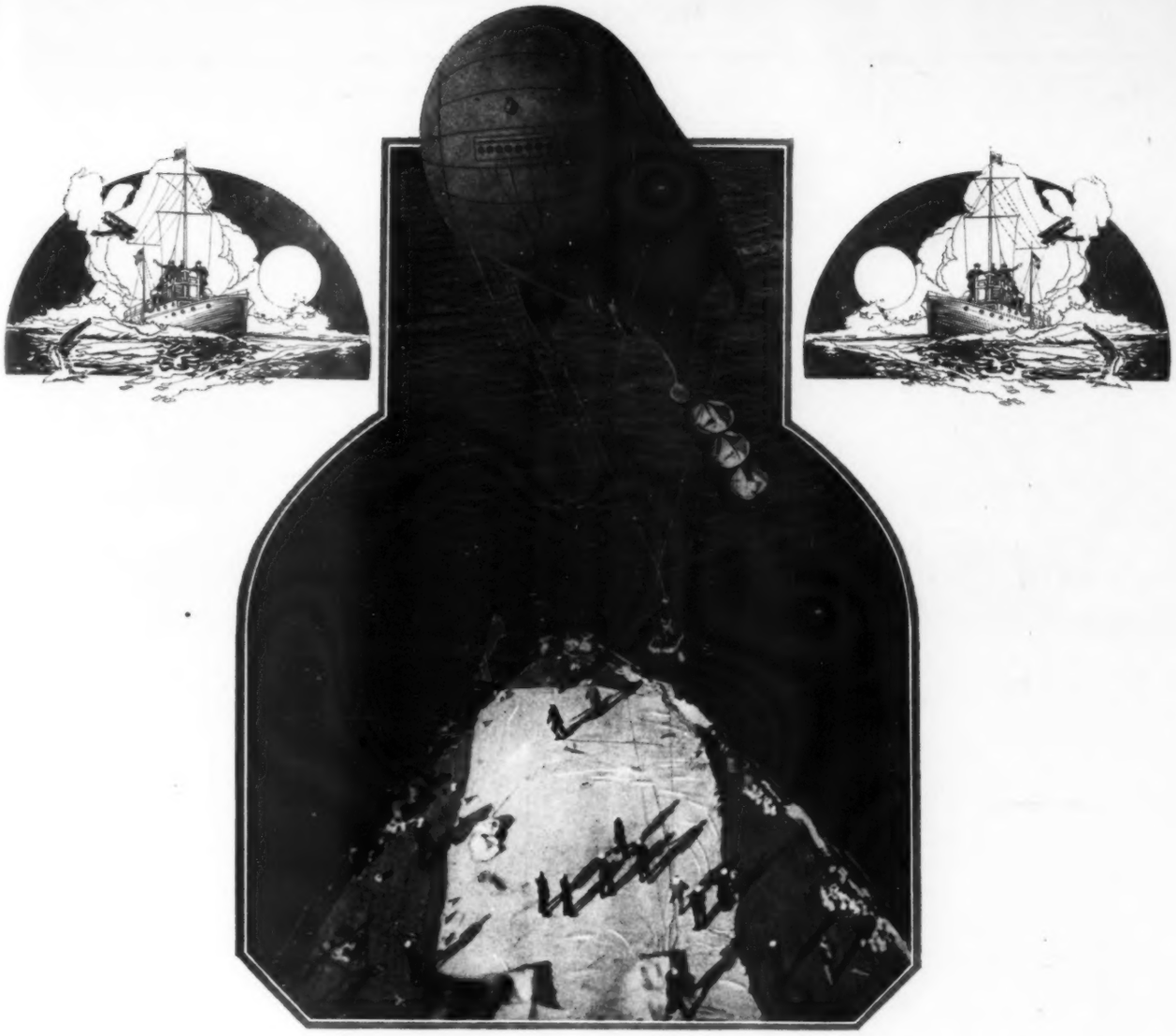


All Motor Boats Must Be Numbered

Congress Passes the Bill Which Has Long Been Contemplated— No Fee or Other Conditions Imposed

THE bill requiring that all undocumented vessels operated in whole or in part by machinery, has at last passed both branches of Congress and it was signed by President Wilson on June 7. The new law will take effect six months later, that is on December 7, 1918.

Several bills have been before various sessions of Congress during the last few years, providing for the numbering of motor boats but in each instance, Congress has adjourned without taking action. Motor Boating has advocated the passage of a numbering bill since the first but a few trade and other non-boat owning interests have strenuously opposed any legislation which might tend to give the Government any information as to the motor boat fleet of the country. However, nearly all boat owners, clubs, and other yachting organizations have been unanimously in favor of the numbering bills and the Department of Commerce, which is sponsor for the present law, is to be congratulated for its success in obtaining its passage.

The Numbering Bill, which now becomes a law, will affect hardships on few, if any, motor boat owners. On the other hand, it will be a means of protection to the honest and conscientious yachtsman who has no desire or reason to evade the law. The provisions of the bill are so reasonable and considerate of the motor boatman's rights that in a very short time many will be wondering why the plan was not inaugurated years ago.

For the trade and those who have opposed legislation for so long, there will be advantages also. Up to the present time, there has been no means of obtaining the names of boat owners throughout the country, but hereafter such data will be available which can be used by those interested in selling boats, engines and accessories. Furthermore, it is a well-established fact that fully ninety per cent. of the owners, operators, and crews of the commercial and fishing motor boats of the country cannot read, or at least do not read, the various boating publications. A means will now be provided for the manufacturers and salesmen to get into personal contact with that great army of commercial motor boat users which heretofore it has been unable to reach.

The new bill provides that all undocumented motor boats, that is motor boats of less than 16 tons gross burden, except public vessels, shall carry a number of not less than 3 inches in size on each bow. An exception is made of motor boats of less than 16 feet in length which are temporarily equipped with detachable or outboard motors.

The numbers, which must be carried on each bow, may be either attached or painted thereon, the only stipulation being the manner in which it is attached and its color shall be such as to make it distinctly visible and legible.

Collectors of customs in the various customs districts will be charged with the assignment of numbers in accordance with instructions issued by the Bureau of Navigation of the Department of Commerce at Washington. Owners of motor boats will make application to the collectors of customs and the numbers will be assigned by them without any charge or fee whatsoever. The numbers will not have to be renewed from year to year but will remain with the particular vessel as long as she is in existence.

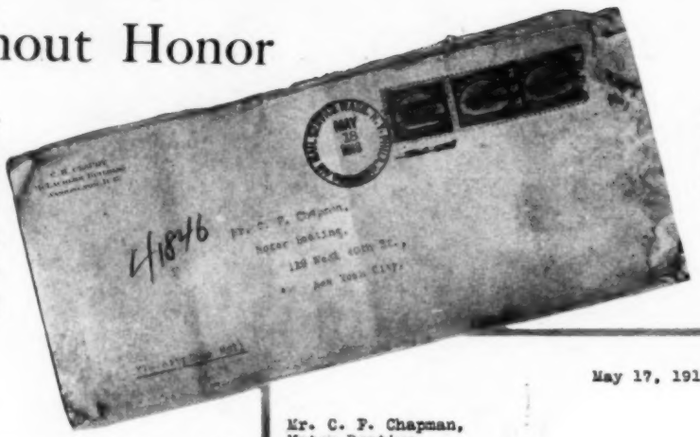
A scheme for assigning numbers has been drawn up by the Bureau of Navigation in such a way that it will be possible to

(*Continued on page* 78)

Prophets without Honor

A Remarkable Story of What the Future Is Likely to Produce on Land, Sea, and in the Air—The First Airplane Article Sent by Aerial Mail to Be Published

By C. H. Claudy



A reproduction of the envelope and letter which accompanied Mr. Claudy's manuscript. Note that three special twenty-four-cent stamps are affixed and the mail service cancellation stamp

May 17, 1918.

Mr. C. P. Chapman,
Motor Boating,
New York City.

My dear Mr. Chapman:

Just why it is that we of America like always to do things first I don't know, but I am sure that never before has a manuscript of a story dealing with aerial matters been sent to an editor by aerial mail. At any rate I am hoping that no one has gotten ahead of me in this respect and, in sending you a story dealing with the near and far distant future of aviation, it seems peculiarly fitting that it should go in the most recent development both of aviation and mail transportation, its very carriage, therefore, adding one more argument to those I have endeavored to present for the wonderful and as yet almost entirely unrealized possibilities of the conquest of the air.

With sincere regards, believe me

Faithfully yours,

CHC/M

"NOT only across the ocean, but around the world!" Thus the enthusiast, who in his off hours was also an inventor.

The layman chuckled.

"No one reads Whittier nowadays," he smiled, "but you might read at least one verse of his with profit. Do you recall,

'O thriftlessness of dream and guess!
O wisdom which is foolishness
Why idly seek from outward things
The answer inward silence brings?'"

"Well, you can laugh. I dare say the 'profit' ought to be spelled 'prophet' and that I am utterly without honor here or anywhere else. But I tell you it is coming. The trans-Atlantic flight waits only time from the serious business of killing Huns, and the poles are but a tenth of the distance from home they were when Peary and Scott fought the ice to get them. If there is such a thing as darkest Africa left, it is a plane, indeed, a whole expedition of planes, which shall bring the light to it. There is to be no such place as an inaccessible one within the next quarter century, and the universal brotherhood of man stopped being a dream of Utopia when Wright flew once and a half around the parade ground at Ft. Myer in 1908. Aviation is ten years old and scarcely well born!"

A squadron of fifteen American planes in battle formation high in the air

"Hear, hear!" cut in the physicist. "Truly a prophet! But you are basing your remarks on things in my field of effort—or is it just on a hope?"

"And by what right do you say that that agency which has made modern war what it is is not yet fairly born?" demanded the officer.

"Don't mind them—I'm with you!" cried the pilot. "I'm too young and tender to get in an argument, but I can fly a plane and I believe that's more than any of you scoffers do!"

It was a gay little party at the club. Present scribe didn't belong in it at all. He sat very carefully reading a newspaper upside down 10 feet away, and most shamelessly listened. He also sighed for a pencil and paper but had to depend on mother wit and a good memory. For this was real, these were men who were doing things and if what they said was of the future, at least it was of the future seen through the spectacles of the science and accomplishment of today.

Enthusiast took up the cudgels promptly.

"I'll convict you out of your own mouths if you'll play fair," he began. "And the army can have first chance at the subject. Suppose you tell us, Colonel, what, in your opinion, the immediate future holds for aviation in military work."

"What do you mean 'immediate'? Do you mean the next year, or the next ten, or the next hundred?"

"Next ten, of course. None of us will see a hundred years hence, therefore, it isn't immediate. The next year any one can see enough of our planes to swamp Hunland." Thus the Physicist.

"All right. The present trend in military aeroplanes, exactly as in anything else military or civil, is specialization. We began with a machine, for war work. Then we split it into two and arrived at a swift scout plane and a slower plane for observation work. Now we are going through a chrysalis stage of a dozen different kinds of planes—night bombers and day bombers, observation planes, scout planes, battleplanes, pursuit planes, reconnaissance planes. Some climb fast and fly slowly, others climb badly and go like the wind, some are big, some small, some carry one, some a dozen men, and so on. It is my belief that we have just started and that the next ten years will see as many types of planes of air use as there are vessels for sea use. Of course, a motor boat can tow, and a tug boat can carry munitions, a transport can be made into a hospital ship and a battleship may do scout duty. But those things are best done and done best when done by and with boats made for the purpose. No one hunts submarines in a catboat any more, or would dare an undersea freight carrying journey in a torpedo carrying submarine.

"I believe the fighting of the future will be as much more artillery than the fighting of today, as that of today is greater

An American dirigible, a typical present day aircraft used by our Army and Navy

This is one of the first photographs to arrive in this country to be passed by the censors showing American hangars in use in France. This was taken just back of the front line trenches and it shows the hangar covered with green canvas so that it cannot be seen from any height by German observers

A type of machine used by our airmen in France

than of the wars previous to this one. That is simply because of the control which aerial observation gives to the gunner. Cavalry, in olden days the scout organization, is now closely kin to dodo. Mobile artillery, meaning that which can dash onto the battlefield and get into action in the open under fire, is already one with the caveman and the great auk. The airplane is the reason, and the answer. That's why I say it isn't in its infancy—it's already done so much!"

The officer looked triumphantly at enthusiast, as if he had answered unanswerably.

Enthusiast merely grinned.

"Altogether beside the point," he replied. "But let that rest for a moment. Perhaps the physicist will tell us what the future holds in aviation from his point of view?"

"Surely, but I can't confine myself to the 'immediate future.' For the great step forward in aviation, as I see it, hasn't even been visualized in the minds of the practical flier as yet. During the next ten years the progress is going to be wholly along experimental lines, plus the refinement of manufacturing which has produced such wonderful results in other transportation means. If you will recall the first 'safety' bicycle of the eighties, and look at the finished product of the middle nineties, you will see what I mean. The early wheel weighed fifty to seventy-five pounds and had solid tires and was limited to smooth streets. The finished product weighed less than twenty-five pounds, had pneumatic tires and could go anywhere. The first automobiles were expensive, heavy, clumsy, without power. Those of today are light, speedy, inexpensive, and with wonderful power. Yet the basic idea was the same, both in the modern bicycle and the modern automobile. It is improvement in type, in manufacturing, in refinement, which has worked the miracle.

"The same thing will continue to happen to the plane. It will get better and better, faster and faster, and also slower and slower, when wanted, by refinement of design, improvement of engine, perhaps artificial fuel, by better propellers, less drift for the surface, greater thrust, and better proportion of lift, all due to better, constantly better design.

"But as long as a gasoline engine is the source of power, so long will the possibilities of aircraft be as rigidly circumscribed as are the possibilities of the steam locomotive, with the present width of track and the present need of curves, even of large radius."

"Surely you don't think of any other form of power plant?"

The officer looked distinctly shocked.

"Why not? Did any one dream of electricity when steam was a modern marvel? Did any one even dream of the gasoline motor as a factor in every day life when the automobile was born? Why not another source of power? For the future with an indeterminate date I can see very plainly, aircraft everywhere, aircraft for the family as well as automobiles, and as for war—war will then be impossible!"

"Please explain." The officer was still shocked. "It is history that war does not diminish in intensity simply because it is made more horrible. Nothing could make modern warfare more horrible than it is today, and we don't stop on that account!"

"I did not say war would become impossible because too horrible. You do jump so at conclusions!" The physicist held up a hand in protest. "I said war would become impossible, because when you produce a weapon which will absolutely annihilate a whole nation, not only its fighting forces, and when all nations possess that same weapon, war will be put as much into the discard as the arena as a source of amusement, or the torture chamber as an aid to religion. Nations will stop war when they find out that to war is simply to die, as a nation."

"Oh, well, very possibly. But no such weapon is possible."

"Pardon me. It is very possible. And there are less veils

between us and that discovery than you think. Let me ask you—if there were available all the power you wanted, for all the time you wanted, without prohibitive weight or expense, would not your aircraft problem at once broaden and widen far beyond our present horizon?"

"I should say it would!" The pilot spoke emphatically. "Power plant troubles are seven-eighths of all aerial troubles. Give me an engine that wont stop, that never loses power and that doesn't eat its weight in fuel in a few hundred miles and I'll fly round the world for you!"

"Exactly! Well, the power is there. The problem is to get at it. There is just as much force locked up in a stone as in a piece of coal. There is just as much power in a pint of water as a pint of gasoline—only we don't know how to get it out. But we are going to learn how to get it out. And if we don't learn that we will learn that other secret which Mother Nature has yet guarded so carefully that we only sense it enough to know that it exists, the secret of—"

"Wireless power!" The enthusiast shouted it. "I knew it—that's what I had in mind when I said we'd fly around the world."

"But such talk is merely speculation!" protested the officer. "It has no foundation in fact!"

"Oh yes, it has. That's exactly what your own branch of the service told the Wrights, when they first told you they could fly, and it's just what the world told poor Langley when he first actually did fly a small model heavier-than-air machine. But we have manifestations of wireless power all around us. Gravity is wireless power. If we can harness gravity to a plane as we do to a balloon and by some other method than the clumsy means of making a balloon go up because gravity pulls the air around it down, we have wireless power. A lightning flash that rives a tree, wrecks a house, or kills a man is wireless power. The Aurora is a manifestation of wireless power—electric? Magnetic? No one knows. The very wind itself is wireless power. And, in a small way and as yet with no practical possibilities in sight, the laboratory sends power through space. You know of wireless directed torpedos, we have the wireless transmission of messages. Surely that first step is more unthinkable than the second, which is merely to develop the idea, and instead of making a splash in the ether which radiates in all directions rapidly losing force, as a stone makes a splash in water, sending diminishing rings over its surface, make a directed splash in the ether which goes where it is wanted and does work!"

"I wish you'd come back to earth! You are miles too high for me! What's that idea of getting power from water instead of gasoline?

Upper view shows what happens when a bomb is dropped from a plane—one can picture the result a few years hence. Lower view shows the propeller end of a twenty-cylinder French airplane motor

"What is the power in gasoline?" countered the physicist. "It is merely in the fact that the atoms of carbon, hydrogen, and oxygen which combined in a peculiar manner form the colorless smelly liquid we know as gasoline are so loosely held in chemical bondage that, in the presence of more oxygen and heat, they recombine to form other compounds. In that recombination intense heat, and sudden expansion are involved and from this expansion we get power.

"Water is made up of hydrogen and oxygen alone. It is one of the most stable of chemical compounds, hardest to drag apart into its component elements. But when we have it apart, in oxygen and hydrogen, and give it the impetus of heat, we have a powerful explosion. Show me a cheap and easy way to turn water into hydrogen and oxygen and I'll make you a present of Standard Oil stock and buy a couple of square miles of ocean and be wealthy beyond the dreams of Midas!"

"But—but that isn't possible!"

"Well, not yet. But it may be. Personally, I think the ultimate power will be neither wireless nor explosive from any chemical, but molecular. Radium. Emanations. No, I won't tell you what it is. I don't know. No one knows why the sun stays hot. Some say because it contracts, others say because of electrical causes, others talk of magnetism, and others yet, speak of radio-active properties. We do know that a minute quantity of radium gives off power without apparent loss to itself. Its molecular activity is simply made manifest to our means of detection, our understanding. That the simply incalculable force in everything about us—molecular power—is never to be made available is unthinkable.

"I said a moment ago that the next ten years would not see this development,—of course, I don't know that it won't. But as a general rule of scientific progress, we go to the limit with one discovery before we get to the next one. The age of steam gave way to the age of electricity—it did not develop coincidently with it. Yet electricity, the telephone, electric light, the motor, the power house, wireless, X-rays,—all were there, then secrets locked up in nature, and needing only brains to get them out. The cave men had waterfalls — the same waterfalls we as yet treat so lightly. If we ever do have wireless electrical power, there will be no unharnessed waterfall in the world, and there will be thousands, almost millions of artificially created falls.

"Just imagine it, gentlemen. Your plane has no fuel to carry. It draws its power from space with no more

(*Continued on page* 94)

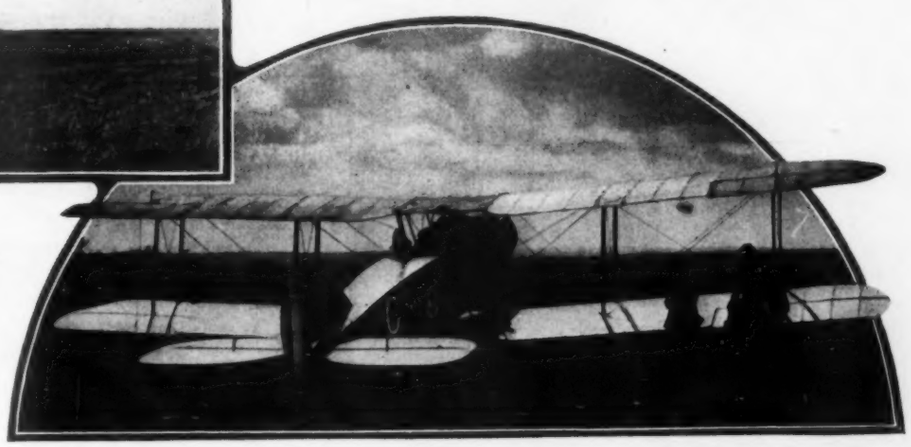
England's Eyes on the German Drive

British Official Photographs

It is to the Royal Flying Corps that the British Army look for information as to what the enemy is doing, to correct the range of their artillery and keep the German aerial observers well behind their own lines. They have co-ordinated the work of the observation planes, battleplanes and bombing planes to such an extent that during the recent drive it was a rare occurrence for a German airplane to even get as near the front as their own lines. Every pilot in this photograph has brought down at least three Hun airplanes

Taking aboard ammunition before a flight. The special pattern air-cooled Lewis machine gun is mounted on a frame that lays close to the fuselage when not in use, but can be swung up and held by the toothed arc in any position while the gun is in operation. Guns for use on airplanes are fitted with sights for this particular work

Fighting plane of the British Royal Flying Corps leaving the ground to meet an approaching German plane. During the last few weeks few enemy aviators have risked an encounter with a British machine



British battleplane preparing for a trip behind the German lines by moonlight. The enemy is given no rest. Day and night, the British planes hover over the trenches and patrol the territory behind the lines, dropping bombs and giving the Boches no time to rest

An All-American Airplane

Head on view of Lawson airplane powered with a four-cylinder Hall-Scott motor

THERE are a great many important features in this the latest Lawson airplane, that cannot for well-known reasons be fully described. A general outline and approximate figures of the machine are given below.

This airplane as being built at the present time is intended for advance training work and reconnaissance. The maximum wing span is 39 feet for the upper plane and 36 feet for the lower plane. The overall length is 25 feet and height 8 feet. When fully equipped and carrying two men of average weight the total weight of the machine and load is 1,900 pounds.

The motor that has been adopted as standard equipment for these planes is the four-cylinder 100 h.p. Hall-Scott which gives a speed range from 42 to 90 m.p.h. By using a 200 h.p. motor it is possible to convert this machine into a fighting plane.

Both wings are in two sections, the top being attached to the cabane by means of hinges while the lower ones are secured to special fittings and cross tie tubes in the fuselage. Both wings are connected by two pairs of interplane struts on each side of the fuselage.

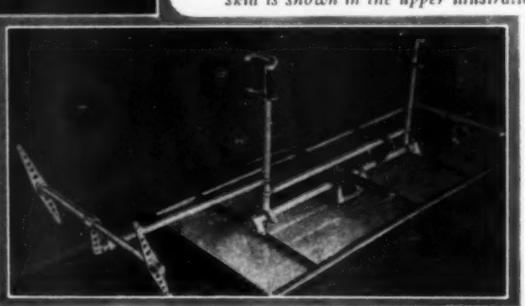
The front of the fuselage is covered with aluminum of the one-piece type. The nose is slightly oval in form and is provided with air holes. The main engine cowl is formed to shape and is bulged out on each side and the bottom, and is provided with inspection doors with louvres. These can be entirely removed by turning a small handle.

The deck cowling is made in three sections. The first can be detached for inspection of the gasoline tank, while the second, which carries the pit padding, can be replaced by a solid cowl in case only the rear seat is used. Back of the cowling a linen-covered turtle-deck is attached by means of hinges which allows easy inspection of all parts in the rear of the fuselage.

The landing gear is of the usual V-type having two 26 x 4-inch wheels mounted on a specially heat-treated axle and sprung by rubber cord absorbers. The guide is set at an angle to take the line of axle action more direct, while this latter as well as the spacer tubes are enclosed by a streamline casing. The struts of ash are provided with heavy cable bracing to take all side strains. The various pieces entering into this assembly are shown in the illustration. The tail skid is universally mounted, the joint being so designed that breakage from a side swipe is almost impossible.

The landing gear is exceptionally simple and at the same time of great strength and easily dissembled

The control is arranged with a stick and foot lever in each pit. The tail skid is shown in the upper illustration



During three days of trials this airplane made twenty-four flights covering about 1,000 miles at a speed from 84 to 86 miles per hour

© Photographs by Underwood & Underwood and International Film Service

"Over There"

In modern warfare all operations are planned and directed from headquarters far behind the actual battle line. For this purpose the most elaborate maps are prepared, showing the topography in minute detail as well as all military features. The information given on these maps are revised and kept up to date from the notes, sketches, and photographs brought in by the aviators. The illustration shows a pilot and observer of the British Royal Flying Corps reporting on their observations to an officer

Carrying the wounded to the rear on a stretcher is a difficult and dangerous task. The ordinary form of stretcher that consists only of a piece of canvas slung in a wooden frame must be handled carefully or the occupant may roll off. A new form of stretcher perfected by the American Red Cross in France consists of a light steel frame containing a strong cord net and provided with straps and belts which hold the wounded man without discomfort in any position

The French are not leaving anything to chance. The illustration shows the method of handling the 240 m.m. shells. They are brought to the gun emplacement on trucks running on light, narrow gauge tracks. A small crane with a special grip is used to place the shells on skids until needed or lands them directly on the loading carriage shown between the crane and the breech of the gun. When loading the gun this carriage is pushed forward and the shell is slipped into the open breech

Flying on Terra Firma

The Effect of High Altitudes on the Heart and Lungs Can Now Be Studied without Leaving the Earth

By Robert H. Moulton

IN order that applicants for air service in the aviation corps of the United States Army may be better tested as to their mental and physical fitness for the work, Dr. Charles M. Robertson, a Chicago ear specialist, has devised an apparatus which simulates an actual flight.

Although the tests now employed by the Government are very rigid, they do not show how a man will act when subjected to the different pressures of atmosphere encountered in flying. The pressure of the atmosphere at the earth's surface is 14.7 pounds per square inch. As we ascend, this pressure decreases, being at 25,000 feet, for instance, less than one-half this.

Under such conditions men are affected differently, as is shown by mountain climbing. Some show little change from the normal, while others suffer in more or less degree from nausea, dizziness and even partial paralysis. Under such circumstances an aviator is more than likely to lose control of his machine and fall to earth. A man may pass all physical examinations, and seemingly be perfect, and yet succumb to sudden changes in air pressure and temperature.

The device invented by Dr. Robertson now enables the examiner to send a man on a flight upward of several thousand feet, to have him drop suddenly, as aviators are frequently forced to do, and to watch him closely for any unfavorable symptoms. It consists of an air-tight steel cabinet about 5 feet high and 3 feet square to which is attached a powerful vacuum pump for removing air. There is also a mercury scale, or altigraph, which shows the degree of rarefication created within the cabinet, and therefore the height to which the subject being tested has ascended. A heavy plate glass window in the front of the cabinet is for observation purposes.

In testing a man the door of the cabinet is locked after he enters, thus making the compartment air-tight. Air is then pumped out in determined quantities, until the man reaches the altitude desired. When it is desired that he shall fall, air is allowed to enter the cabinet. After several ascents and descents in this manner (the time for each being approximately that required by the aviator in actual flight) the subject is then taken from the cabinet and tested as to his blood pressure, muscle tone and the labyrinth tests of the inner ear.

The changes in the men thus tested have in many instances been very marked, 35 per cent. out of one series of 100 men showing symptoms which, in Dr. Robertson's opinion, would disqualify them for air work. While the majority were very much exhilarated by the flight, on reaching the pressure of the earth's surface they changed from a ruddy, flushed color to a sickly greenish hue, with evidences of great shock. In a few instances the men actually lost consciousness.

For close to earth maneuvering a man does not need to be so fully adjusted, but for war work, which entails rapid ascents and descents, he must be able to withstand the corresponding changes in air pressure. Dr. Robertson is of the belief that many of the falls which have occurred at our aviation training camps have been the direct result of inability to do this.

Watching the altigraph and the man under test. The scale is so graduated that the reading indicates what altitude corresponds to the pressure within the cabinet

The cabinet is entered from the back, the door with its heavy locking mechanism resembles a large office safe

The complete apparatus consists of an air-tight steel cabinet with glass panel, altigraph and air control valves together with an electrically operated vacuum pump for rarefying the air in the cabinet to simulate high altitudes

Dr. Robertson has offered his invention to the Government, and in view of the fact that it is the only known means by which susceptibility to varying degrees of pressure can be arrived at, the value of the test becomes apparent.

Under the present methods employed in training aviators the beginner is observed while flying with an instructor, but naturally the instructor is unable to closely watch the physical condition of his companion. It is possible for a student to appear physically fit and yet not be in a condition to properly control his own airplane.

America's Wire Chief

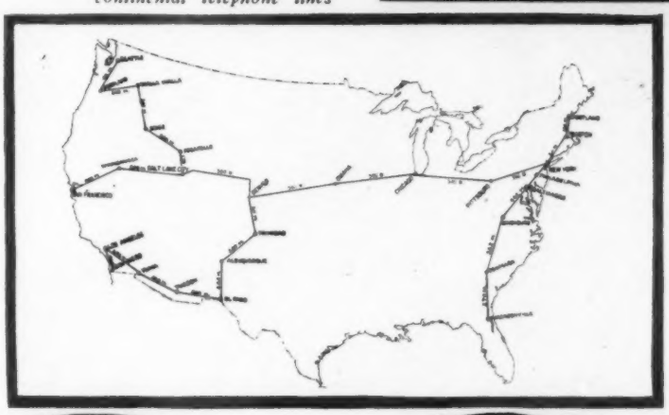
The Man Who Organized Our Telephone System in France

By John Walker Harrington

TWELVE battalions of the Soldiers of the Cam are now in France with Pershing and many more are ready to join him. The story of how they were enlisted was told the other night when Colonel John J. Carty, in khaki clad, rose to accept another medal for distinguished service to science.

Long before this country entered the war for the freedom of the world, Major General George O. Squier realized that the United States Signal Corps, of which he is the head, would not be able to cope with the situation when the inevitable arrived. He went for help to his fellow scientist, John J. Carty, the chief engineer of the American Telephone & Telegraph Company. Out of that conference sprang the Signal Corps Reserve. It was

Colonel John J. Carty, Signal Corps—U. S. A.



Map showing location of transcontinental telephone lines

recruited months before this country joined in the fight against the Hun. Those composing the organization are engineers and operators of the Bell system who, serving without pay, trained themselves to apply telephony to warfare.

Scores of them sailed with Pershing and his staff and others followed by every ship. With what zeal these alert young men from a hundred colleges and universities went about their appointed tasks when they reached Over There! They connected the great American Base with the sector assigned to our troops at the Western Front. They spread a network of wires which articulated munition plants, repair shops, transports, and railroads into a mighty military organism.

Were it not for the bravery and the ability of these Soldiers of the Cam, lifting the tiny levers of the switchboards of telephones in dugouts or crouching at listening posts, the grim business of war could not have proceeded with the efficiency that it has. Night after night they lie out in the darkness of No Man's Land, receivers on their ears, locating the tunnels of the foe. They take the place of the galloping orderlies and couriers of old as from the inferno of the barrage they send reports over the vibrant wire.

Josephus Daniels, Secretary of the Navy, asked that some way be devised to bring our fleets and navy yards into closer touch. When the day of Navy mobilization came, Rear Admiral Benson picked up a telephone and spoke certain orders to a station in Seattle, more than 3,000 miles distant. John J. Carty

(*Continued on page* 96)

Forging Uncle Sam's Armor

The Never Ending Contest Between the High-Velocity Gun and the Armor Plate Maker

WOODEN warships passed out of style the day the Confederate iron-clad Merrimac steamed down Hampton Roads to attack and destroy the United States sloop-of-war Cumberland and frigate Congress. Both these doomed Federal ships opened fire on the Merrimac; but as we have learned so well in our school histories, the shots simply glanced off the sloping armored sides of the Confederate monster.

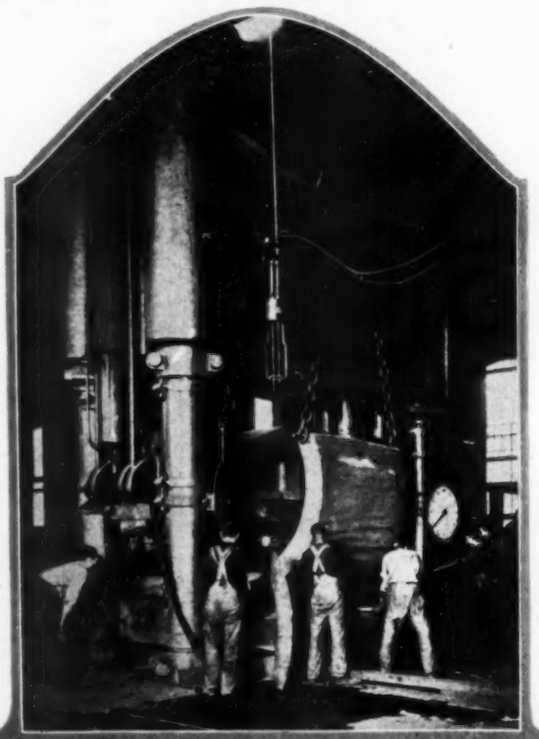
It was a dark day for the Union. For what was to prevent the invulnerable Merrimac from destroying the Federal blockaders one by one?

But luck was certainly with the Union. The Monitor had been launched in New York and had made the perilous journey to Hampton Roads. The following day when Merrimac steamed back to the scene of the battle with the obvious intent of finishing a task so well begun, it was met by the strange little Federal craft with the sunken, plated hull and the armored turret housing two 11-inch guns. In the ensuing fight between these two strange warships the Merrimac was worsted, due no doubt to the small and invulnerable target represented by the Monitor and to the great power of the latter's guns.

Then and there naval history began anew: the ironclad or armored warship definitely came into being and wooden navies were scrapped for all time. At the same time there started that never-ending struggle between the gun-maker and the armor-plate-maker, or between the offensive and defensive in naval combat.

Progress has been considerable and fairly rapid in armor-plate design. But during the last few years the high-velocity gun has been developed to such a degree that the advantage now rests with the gun. The armor-plate-maker has been left far behind; but far from losing hope he continues to turn out the best plates he knows how, awaiting some new idea or discovery that will again bring the advantage to armor. If history does repeat itself in this struggle, a better balance is bound to be struck again between the offense and defense in the near future.

Armor-plate can be classified under three main types, each of which has proved successful at one time or other, but only one of which has survived. The first type is the hard, rigid, and brittle plate, represented by the all-steel plate. The second is the tough, yielding and homogeneous type, represented by the wrought-iron plate, while the third is the composite type, incorporating all advantages and represented by the compound and carbonized plates now in universal use.



To fit the curved sides of a vessel the armor plate is bent in a hydraulic press. Note the man with the template standing beside the press

A test piece of 6-inch improved face-hardened armor plate after six direct hits with an 8-inch gun. It has been penetrated but not cracked

The first step. Steel ingot under 125-ton steam hammer

While each armor plate-maker has certain minor details which are peculiar to him, in the main all plates are made in more or less the same way. So the following description of armor-plate manufacture may be considered as typical of the industry.

The first step is the melting of the steel in furnaces fired by gas, each of which will melt forty tons in about twelve hours in the case of the plant taken for this description. The molten steel is then drawn off into ladles and transported by electric cranes to the huge iron molds in another part of the plant. Here it is poured into these molds in order to form ingots, some of which weigh 50 tons and are 36 inches thick. The molds, without the steel, in some cases weigh as much as 60 tons.

After being reheated the ingots are rolled out in a huge mill. In the plant under consideration one of the mills has rolls 36 inches in diameter and 12 feet in length. Within half an hour the ingot is rolled down to 6 inches

uniform thickness, but the edges are far from being smooth and regular.

At this point in the process the surface-treating phase is ready to be entered into. The plates are laid one on top of another in specially constructed furnaces, and powdered charcoal is sprinkled between the opposed surfaces. The plates are allowed to remain in the furnaces from ten to twelve days; all the while the temperature is carefully maintained at a fixed point by means of pyrometers.

The action in the furnaces is simple. The plates absorb the carbon in the powdered charcoal, increasing the carbon content at and near the surfaces. However, this does not result in the hardening of the plate surface, but it does prepare it for the subsequent hardening which is done at a later stage.

Obviously, armor plates are made both flat and curved, according to their intended use. The bending is done in powerful hydraulic presses; in the plant considered there are two machines of 8,000 tons power, which will bend plates up to 21 feet long and 11 feet wide. Each press weighs 600 tons, and the pressure exerted is 3 tons to each square inch of the rams. As can well be imagined, the bending of armor plates is quickly accomplished between the powerful jaws of these presses.

Photographs by Brown & Dawson

Huge 14,000-ton hydraulic press used to trim the steel ingot before going through the rolling mill

Before being put through the rolling mill the steel ingot is reheated in a special furnace

All plates, whether curved or straight, have to be finished on the edges, or planed, to use the accepted term. But before this is done the surfaces are planed smoothly to make the plates of absolute uniform thickness. This work is done on machines capable of carrying a plate weighing 30 tons on a moving table of about equal weight. The table reciprocates the plate under the cutting tools which cut in both directions. The work is moved along at the rate of about 11 feet a minute. In another type of machine the plate is held stationary, while the tools are moved over the surface. In either case the results are the same, namely, to finish the surfaces and make the plates absolutely accurate so as to subsequently fit in place.

Then the edges are finished. The rough and irregular edges are planed in various kinds of machines. In instances where the plates are to be provided with bevel edges, the tools are held at an angle by the hinged tool holders provided for just that purpose. In instances where a large quantity of metal has to be removed, the work is expedited by the use of a circular saw. Irregular edges present no difficulties to the workers; for they are taken care of in a machine provided with a movable tool saddle, the cutting tools being controlled by a templet of the same design as the edge planed, and on which travels a guide pin. In some instances the edges have to be slotted, in which a saw-like arrangement is resorted to.

Before the plates are hardened all the machine work must be done. Holes have to be drilled in the faces and screw threads cut in them. These holes are usually plugged with clay in order to protect them during the subsequent hardening processes. In the case of the holes at the back to receive the bolts by which the armor plates are screwed to the hull of the ship, these can be drilled and threaded subsequently to hardening since the hardening process does not affect the back.

There are two stages in the hardening process. First comes the moderate hardening of the plate, or, to be more correct, the tempering, followed by the intense hardening of the outer face. The first hardening permeates the entire plate. It is carried out by heating the plate in a furnace to an exact temperature, and then dropping it suddenly into a bath of cotton seed oil. The quantity of cotton seed oil is such that it does not become greatly heated in absorbing the heat of the steel mass. Meanwhile the plate is hardened or toughened throughout without hardening to a point of brittleness, and while it is both stronger and tougher than it was before immersion, it would not resist a modern soft-nosed shell.

The next step is to harden the surface of the plate. This is done by saturating the surface with carbon to a depth of from 2½ to 3 inches, after which the surface is subjected to chilling. A series of jets of cold water are directed under pressure against the highly carbonized surface which has been heated. After two or three hours of this treat-

(*Continued on page* 98)

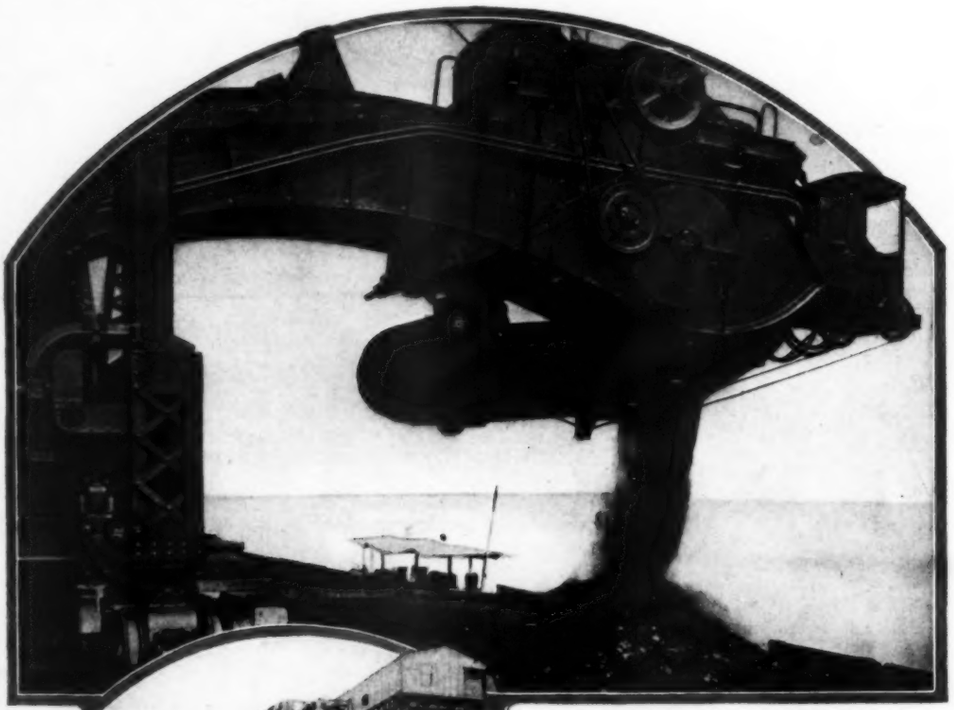
Upsetting the Conventional

How Time and Labor Are Saved By Turning Coal Cars Up-Side-Down to Empty Them

By Robert H. Moulton

JUST what modern engineering can do when it comes to speeding up the loading of coal-carrying ships is shown in the giant apparatus used at the new coal terminal of the Southern Railway at Charleston, S. C. The coal handling machinery has been placed on a 400-foot steel and concrete pier, connected with the mainland by a trestle over which the cars run for a distance of 3,800 feet. The ships are thus able to dock close beside the pier so that it only remains for the big machine to pick up each coal car, usually full to the brim, turn it upside down and dump the contents into the hopper from which it is fed into the holds of the vessel for shipment.

This big automatic coal loader can handle in one day as much coal as was exported through Charleston in an entire year until recently. Its capacity is from 1,500 to 2,000 tons an hour. A heaping coal car can be unloaded or dumped out in about two minutes, and the tower has no more difficulty with a 100-ton car than the average man has with a scuttle. Looking closer at the machinery, we find it consists of a car dumper and loading tower both operated by electricity.



As fast as the cars are dumped the coal is carried to the waiting vessels

The car dumper and coal loader are two separate machines, mounted on tracks at different levels but working together as one perfectly co-ordinated unit able to dump from cars and load aboard ship 2,000 tons per hour

The operation is exceedingly interesting. Cars are pushed into the dumper by a switch engine. When the machinery gets busy, the car is automatically clamped and turned—body, trucks, and section of track on which it stands—to such an angle that the coal pours into the hopper. When the car has been emptied, the dumper returns to its normal position. As another loaded car is shoved into the dumper, it pushes out the empty one, which then runs to the end of the pier and by means of a "kick back," is returned to the storage track ready for return to the mines.

Both the car dumper and the loading tower are movable, running on tracks of their own, and they can be shifted to serve the different hatches of a ship, so that when a vessel is once tied to the pier it is unnecessary to move it until it has been given a full cargo. When the contents of the car are dumped into the hopper by the car dumper, the coal is fed into the holds of a ship by a belt conveyor and a telescopic chute, the end of which has a movable deflector so that the coal is evenly distributed in the hold. The particular advantage of this arrangement is that it eliminates to a large degree the amount of breakage which usually results when coal is dumped into ships by gravity from elevated pockets.

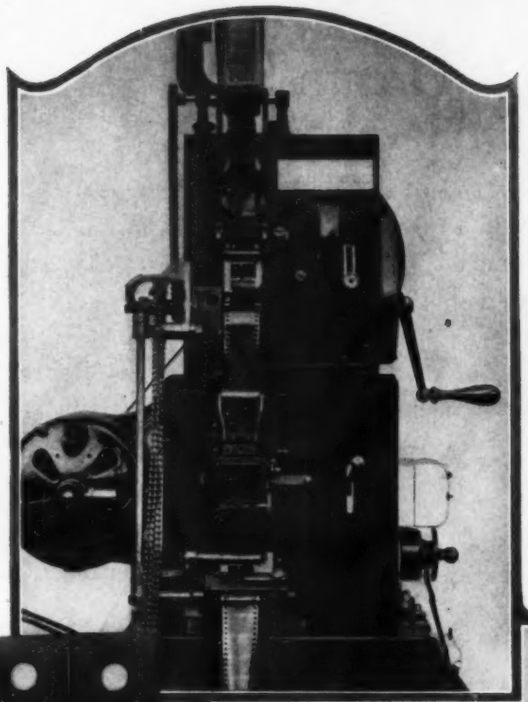
When coaling a steamship the chute is lowered into the bunkers, car after car is dumped into the hopper, and a steady stream of coal is poured aboard. By turning the chute the coal is distributed in the hold

Making the Camera Talk

How Sound Is Photographed and Reproduced with Motion Pictures

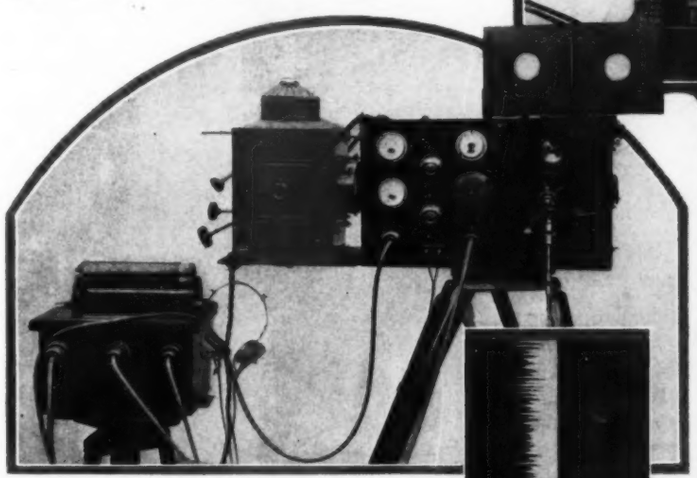
COMBINE a phonograph and a motion-picture projector and you have invented the talking picture! Obviously so; but in practice it does not seem to work out quite the way it should. Many inventors have tried it, among them the greatest minds in the motion-picture field, and they have all failed. And at the bottom of the whole story is that magical little word "if".

If the conventional phonograph reproduced clear and realistic records in such amplified form as to fill a large theatre, the first of the obstacles would be removed; for before anything else the success of the talking picture is based on absolute realism. Then there is the question of long records. With the usual phonographs it is not possible to use a record of a length corresponding to the action or playing time of a film many thousand feet in length. True, the records might be changed,

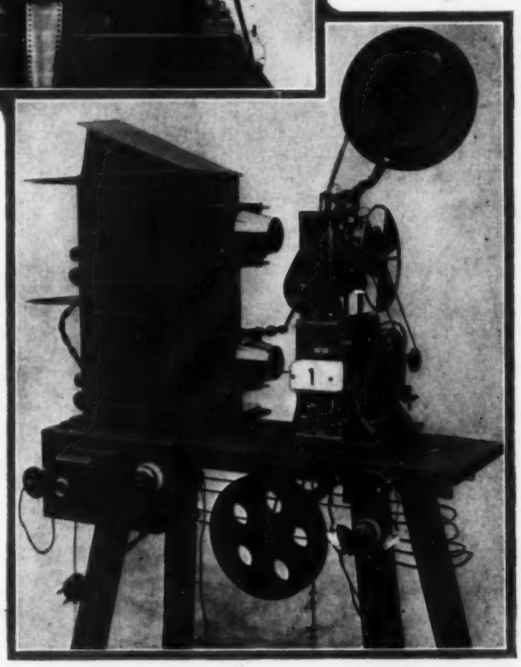


Back view of the projector mechanism. The film first passes before the lens at the top that projects the picture on the screen, then through the apparatus at the bottom, which projects the sound record on the sensitive selenium cell

Photographs by Brown & Dawson



The camera contains the motion picture mechanism in the front part and the delicate sound recording device in the rear part of the same box

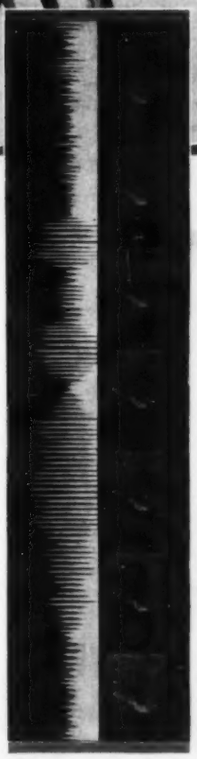


The complete projector is not much larger than the ordinary machine. The selenium cell is mounted on the rod projecting forward from the bottom of the apparatus below the shutter

but the blasé picture audience of today is used to seeing a feature play projected without a break; the day of the "One Minute to Change the Reels" sign is gone forever. Lastly, there is the paramount matter of synchronism. The sound record and the pictures must be kept in step, for it obviously would not do to let one get ahead of the other. Film, no matter how carefully it may be handled, must occasionally be re-spliced, and when this is done one or more of the little images are left out. Now when the film is part of a talking-picture system it is evident that the cutting of the film is not compensated on the sound record, hence then and there the system is no longer in perfect synchronism. This synchronism is a most baffling problem, and it has always been the bête noir of the talking picture.

Now comes Eugene Lauste, who has made a study of motion pictures since 1867, with a photographic system of recording sound, which, in combination with the usual motion-picture camera and projector, appears to be the foundation of a successful talking-picture method. At one sweep the new system does away with a stylus and its inherent scratchy sound which is amplified along with the desired sounds, so that it is always present and objectionable; with the problem of perfect synchronism, and with metallic and false reproductions.

What Mr. Lauste does is to photograph sound on the margin of the film which receives the photographic images, so that the same film serves the dual purpose. In this manner the apparatus is greatly simplified, and the synchronism becomes rigid and absolute. In recording the sound a sensitive galvanometer is employed, the fine-wire indicator of which throws a varying shadow on the strip of film passing back of it. In reproducing the sound the same film is passed before a selenium cell, and the varying proportions of light and shade alter the current supplied to a loud-speaking telephone.



A strip of negative film showing the sound record on the left side and the pictures on the right hand side

The galvanometer of this novel system for recording sounds is connected in circuit with a number of sensitive microphones of a type similar to those employed by detectives in eavesdropping. These microphones are distributed about the stage or location so as to catch the desired sound waves. Indeed, one of the leading advantages of this system is that the players are not confronted with the necessity of singing or talking into a huge horn at the same time as they are acting. Nor do the players have to speak or sing louder than usual; and these features go a long way toward giving them their customary freedom and producing a more realistic result on the screen.

The current that passes through the microphones is varied in strength according to the sound waves impinging on the diaphragms, just as in the case of the usual telephone circuit. These fluctuations in current act upon a fine wire or "string" suspended in the field of a powerful electro-magnet, forming the galvanometer, with the result that wire is warped out

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1918

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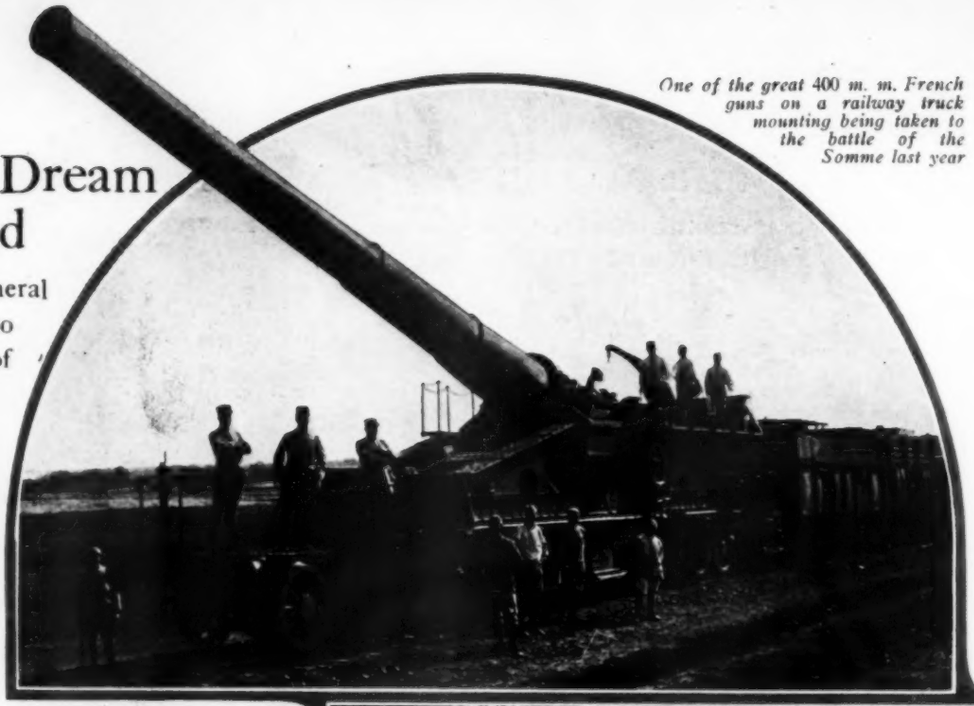
Napoleon's Dream Realized

The Great French General Was the First Man to Appreciate the Value of Field Artillery

© Photographs by International Film Service



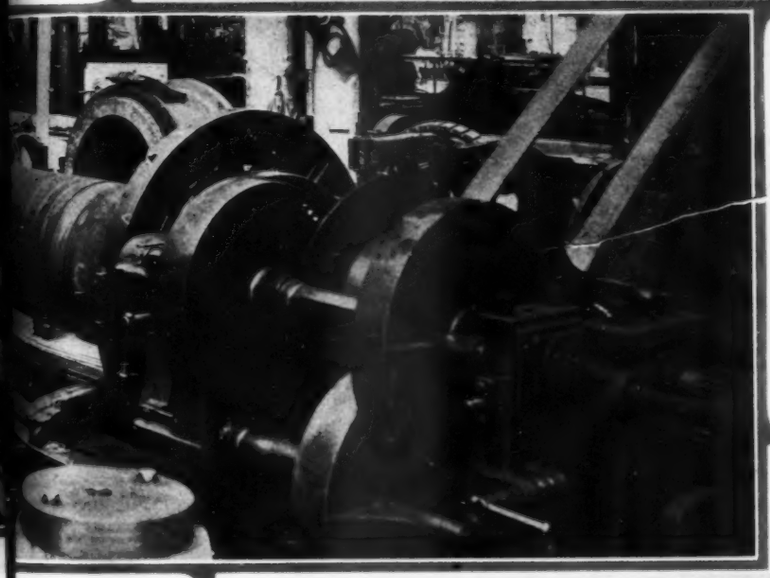
One of the great 400 m. m. French guns on a railway truck mounting being taken to the battle of the Somme last year

DURING the last four years a transformation has taken place in practically all forms of ordnance. In no similar period of history has the improvement been so rapid. The engineers of every country, working under the pressure of necessity, have directed every possible energy to rendering guns more efficient. In this mad race for supremacy both groups of contestants have been surprisingly well matched. Each side has put forward marvelously ingenious pieces of construction, great discoveries have been made, but neither side has been able to outclass the other. No sooner has some marvelous new gun appeared than it is faced by another piece of ordnance which more or less balances its effect. This is as true of naval guns and battleship armor as of field artillery. It has been a continual struggle between the gun and armor makers, with first one and then the other in the lead.

Few realize how recent an invention is the complex gun of modern warfare. The familiar form of breech-loading gun dates only from the Crimean War. The great cast iron guns were first perfected in the United States during the Civil War. As the charges of explosives were increased, it was found necessary to build up the gun with concentric tubes shrunk together. American gun makers first shrunk hoops of iron around the breech of cast iron cannon and by gradual experiment the modern form of construction was developed.

French anti-aircraft gun mounted on an auto truck. The most mobile branch of the artillery and one that never has a fixed target

Hiding the guns from the enemy observers is as important as finding the correct range. A camouflaged 400 m. m. gun in a forest



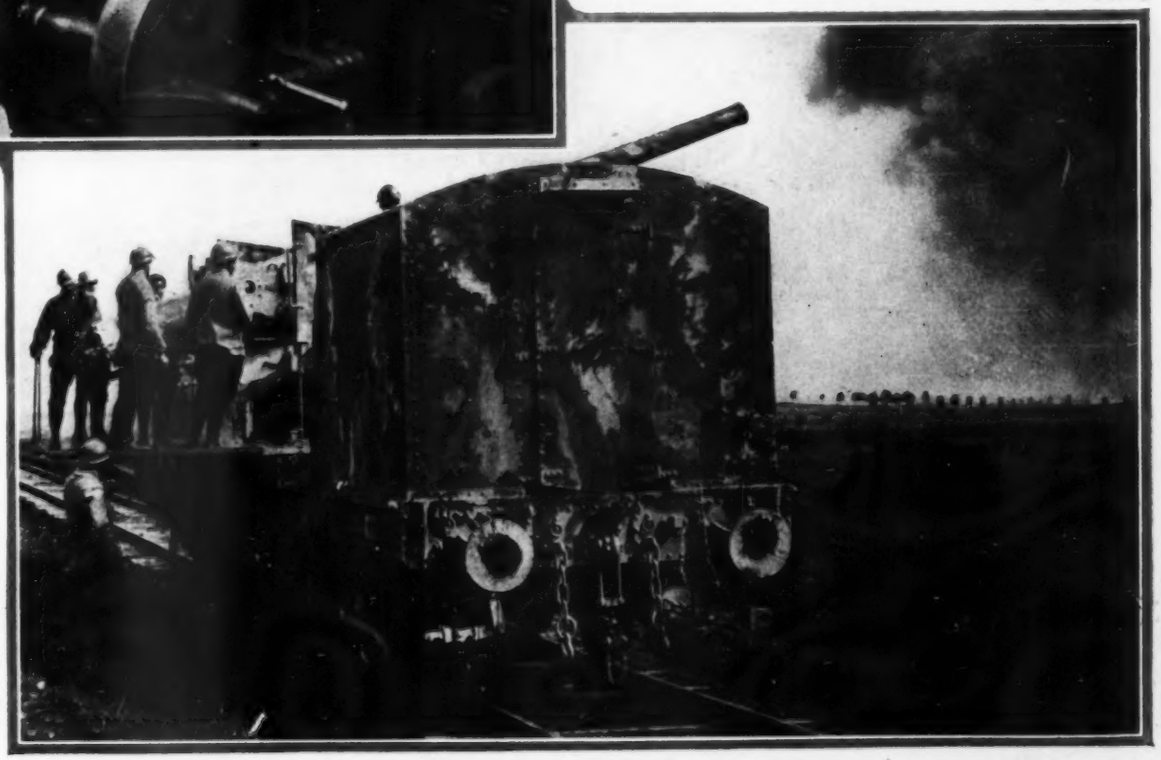
Big gun in a lathe being turned down and smoothed off before shrinking on the next steel tube

It was not until 1881 that the first all-steel gun appeared in France.

Today the gun makers of all the leading countries are pretty well agreed as to the best method of gun construction. Although the details may vary, the steel is first cast as ingots in the form of truncated cones, which are forged out with several heatings, and finally turned and rough bored. The rings are then shrunken on and the gun is bored and rifled. The giant lathes and other machines used in such work are marvels of constructive skill, since they must combine great strength with the utmost accuracy for this work.

The force exerted by the explosion on every part of the cannon is accurately measured. Nothing is left to chance. It has been found, for instance, that the muzzle velocity of a great modern gun is often over 53,000-foot tons, or an increase of more than 800 per cent in driving force, compared with the largest guns of a few years since. This increase has been obtained by increasing the power of resistance of the barrel and increasing the charge of explosive. The lengthening of the tube has also had great influence in increasing the range and effectiveness of modern guns. The best guns of a few years ago were twelve times their diameters, while today they have a length fifty times their bores. It is reported that the super guns with a range of eighty miles used by the Germans against Paris have increased this proportion.

It is interesting to measure the progress of the last four years by recalling our ideas of great cannon before the war. In the United States the direct-fire guns used in the field varied in calibre from 3 to 4 inches, while the high-angle-fire guns or howitzers ran from 4.7 to 7 inches. The 7-inch projectiles of our largest field guns were considered extremely formidable. It was reported that some European armies had guns available for field use which fired even 8-inch shells. The world was soon to learn that Germany had secretly built giant howitzers ranging in bore from 12 to 16.5 inches. The shells hurled by these guns weighed 1,000 pounds. Larger and more powerful guns had, of course, been built both in



Long range gun on railway truck mounting in action. The weight of the truck provides a most stable gun platform

America and Europe, but they were of the seige gun type. The effectiveness of the new guns was largely due to the fact that they could be moved quickly from place to place.

The rivalry in gun building has been so close, however, that the Germans did not long enjoy the advantage of supremacy. The British and French gun makers started out to match the new gun and succeeded. In the battle of Picardy the British brought up giant new howitzers which discharged shells weighing 1,700 pounds, hurling them a distance of 7 miles at the rate of one shot per minute. Following the example of the Germans the English mounted these great guns on motor trucks which could be transported cross country at surprising speed. By the time the battle of the Somme was fought the French were able to bring forward their great 400 mm. guns mounted on railroad trucks, which more than balanced the power of the great Krupp guns.

The builders of modern guns have accomplished a marvel of mechanics in overcoming the recoil of powerful guns. In the earlier forms of field guns little success was obtained in counteracting the kick or recoil of the gun. With the explosion the gun would run back several feet and the aim would be lost. Valuable time was lost in bringing the gun back into position and aiming it at its target. The modern guns with their marvelous system of non-recoil springs or cylinders make it possible to keep the gun constantly trained on the enemy. Even large guns thus equipped can be fired from twenty to twenty-five times per minute. The problem has been solved by keeping the carriage of the gun stationary and allowing the gun itself to recoil on this track. The enormous force of the explosion is stored up and employed to bring the gun back into its original position. To take up this recoil hydraulic cylinders are used, or some system of counter weights or springs. Some idea of the strength and delicacy of the machinery may be gained from the fact that the weight used with a 12-inch gun weighs about 150,000 pounds.

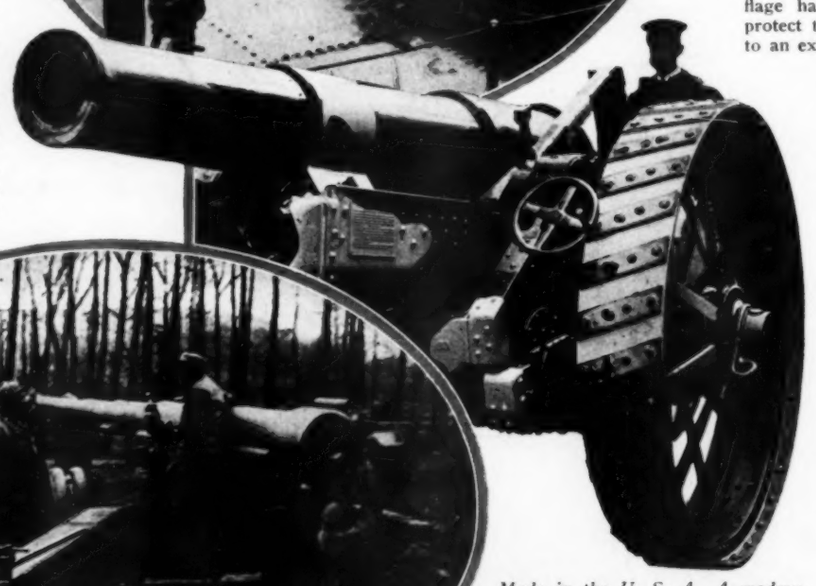
One of the most remarkable mechanical feats of the Great War has been the construction of mobile cannons of great range and power. The most powerful cannon may now be moved from place to place even more quickly than a body of troops can make the journey. The cannon is mounted and fired from specially constructed railroad trucks, or from motor trucks of various forms. The automobile battery is extremely mobile and can be rushed over roads which before the war would have been considered impossible even for light artillery. The American tractor again has revolutionized the transportation of artillery. Until the outbreak of the war no one had thought of this simpler method of moving guns across open country. Today some of the most effective cannons are moved entirely independent of all roadways.

The methods of loading the guns has been completely changed in recent years. Many old soldiers today can remember the muzzle loading cannon. The process was painfully slow and the gunners' crew meanwhile was exposed to the enemy's fire. In all modern guns the breech is opened with a single movement, the metallic cartridge is slipped into position and the breech is closed and locked as readily as one would close a door. In some cases a shell is placed in position in its original package or container, so that no hand touches the case and it is kept absolutely free from dirt of any kind. All these time-saving devices have greatly speeded up the rate of fire. The empty cartridge cases are thrown out by an automatic device which relieves the gun crew of the trouble. An expert gun crew can fire from fifteen to twenty shots per minute.

The modern gun crew again fire from behind a very effective defense. Special attention has been paid to designing and building steel plates and attaching them to the guns in such a manner that they will deflect every possible shot. These plates are proof against the fire of machine guns and rifles or pieces of shrapnel. The crew can thus continue to serve their guns for instance even in the face of an advancing enemy. Only the direct fire of a rather formidable battery can drive them from their posts. The use of camouflage has also served to protect the crews of guns to an extent scarcely conceivable a few years ago. During our Civil War, for instance, thousands of lives were sacrificed which might have been saved by the ingenious use of the paint brush. The use of smokeless powder again makes it extremely difficult to locate the position of a field battery from any distance, and the enemy may work for days without finding the proper range.

One of the secrets of the immense power of modern guns lies in the angle at which they are discharged. The shells of the powerful guns rise in the air to immense altitudes and gradually fall, increasing their striking force by the additional pull of gravity. The mathematics of gun fire has been wonderfully developed in recent years, so that a shot fired in this way may be aimed at an invisible target several miles away with surprising accuracy. The anti-aircraft guns may be fired upward at angles which would have been thought impossible only a few years ago. They may be swung through a wide arc and aimed with great accuracy. Since an airplane flies at a speed of 100 miles an hour or faster it is important that these batteries be extremely mobile.

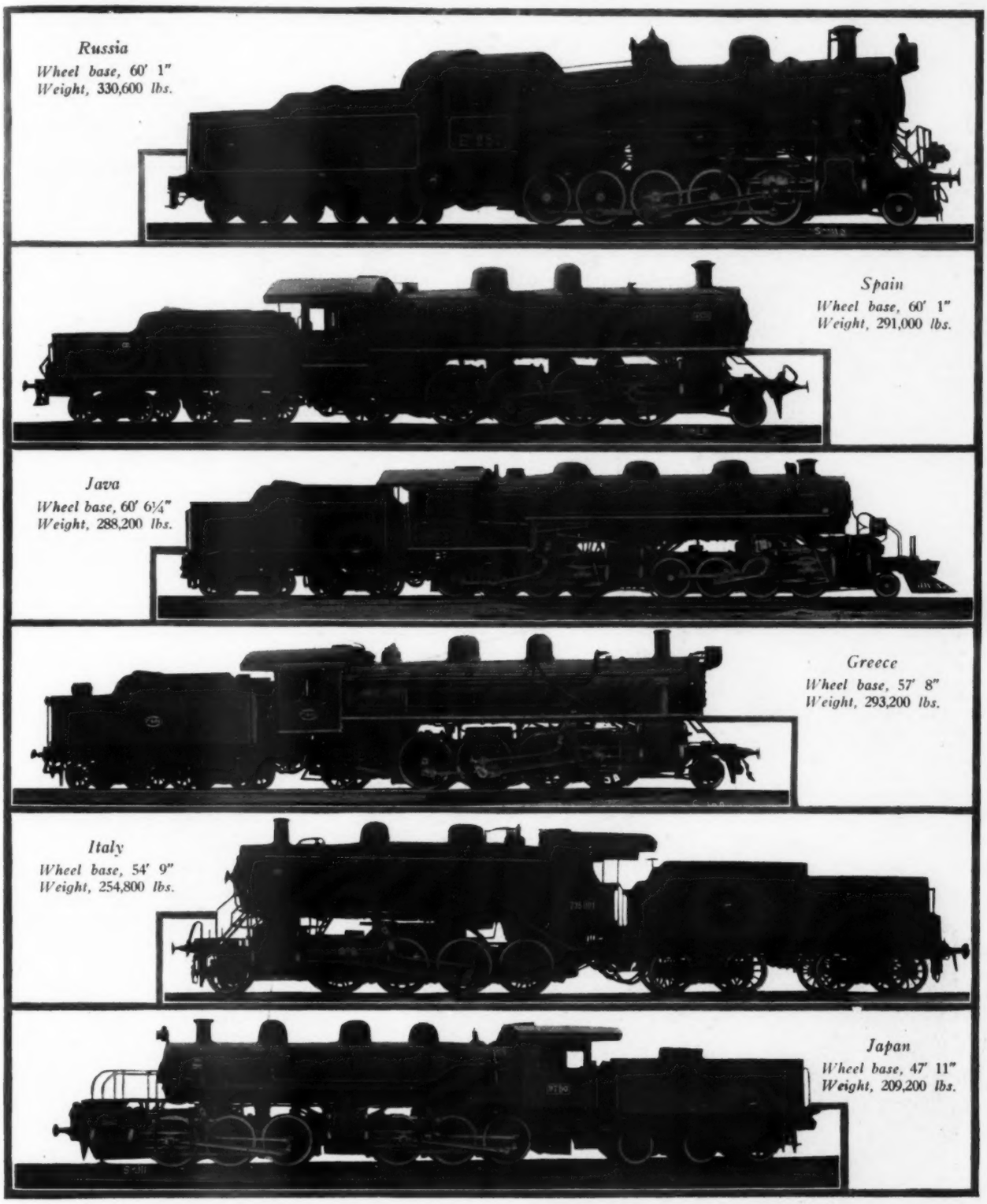
Anti-aircraft guns on a French gunboat of a type used to patrol the canals and ward off enemy airplanes



Made in the U. S. A. A modern 8-inch howitzer for our boys in France, showing camouflage painting

Heavy French field piece with double trail, enabling the gunners to change the direction of the fire without moving the gun carriage

American Made for the Whole World's Trade



THAT the railway industry of the United States has reached a more advanced state of perfection than in other countries is clearly indicated by the adoption of American design in locomotive construction and the purchase of American-built engines by foreign nations.

The six locomotives shown above were built by the American Locomotive Company for Russia, Spain, Java, Greece, Italy, and Japan. The Russians have adopted the slow but powerful decapod used in this country mostly for heavy freight service. Spain and Greece have selected an eight-driver locomotive patterned after our Pacific type, while Italy has chosen a type of eight-driver engine extensively used for yard work on the Eastern roads.

Java and Japan are using locomotives of the compound, articulated Mallet type similar to those used for the heaviest freight train service in America. These locomotives have a high factor of adhesion and a very short rigid wheel base (11 feet 9 inches in this case) which enables them to negotiate very sharp curves. The forward group of drivers and their cylinders are mounted on a separate frame pivoted to the boiler and using the exhaust steam from the high-pressure cylinders that actuate the rear group of drivers.

Although these locomotives are designed according to the latest American practice, they are somewhat smaller and lighter than those in use on American railways. The largest locomotive shown on this page (Java) has, with its tender, a wheel base of 60 feet 6¼ inches and weighs 288,200 pounds, whereas a locomotive of this type for use on an American road would have a wheel base of from 90 to 110 feet and weigh over 400,000 pounds.

Wireless Music

Recently Perfected Radio Device That Will Send Music or Speech to Individual Pocket-Size Receiving Sets

By Albert Marple

The transmitting apparatus can be connected at will to either the telephone or phonograph, and can be operated with a storage or dry battery

The receiving apparatus is most compact. It is all contained in a small box not much larger than the ordinary hand camera

OUR boys, who are injured while doing their bit over in France, will soon be persuaded to forget their aches and pains, along with all the other hardships of the war, by sweet strains of music, which will be carried to them by wireless. It will seem for all the world to these boys as though the music were being wafted to them on the morning, noontime, or evening breezes as they steal through the open windows of the long, white-walled buildings. These boys will also hear novels, poetry, and news stories read—all this over the wireless telephone and phonograph. The Sammie who is too ill, even for a little entertainment, will not be disturbed, for this wireless material will be distributed in individual doses. This being true, who can measure the good that will be accomplished by this very latest and most wonderful of inventions, and who will venture to state the number of brave lives that will be saved, and the many hours of weary, painful waiting that will be brightened, even by this same wireless phonograph. This new departure promises to usher in a wonderful era, so far as the entertainment of the wounded of this war is concerned.

The first set of this wireless phonograph ever constructed has been purchased by the Ebell Club of Los Angeles, California, for the sum of $1,000. This is being donated by this club to the American Base Hospital in France. This outfit consists of a transmitting set, along with fifty portable or hospital receiving sets, these to be used on fifty different beds. By placing one of these sets between two beds and equipping it with two receivers, each receiving set may be made to bring joy and relief to a pair of our Sammies. Each of these sets may be detached from any bed in an instant and carried for use in some other part of the room or building.

Earl C. Hanson, of Los Angeles, is the inventor of this remarkable apparatus, which is so wonderful that the wireless authorties of the western part of this country have been compelled to sit up as they say. In the realm of music there is nothing that approaches or compares with it. It is the final result of the combined efforts of the leading scientists of the world, which, under the skillful touch of this young inventor, have been made to accomplish wonders.

It is usually the case that the conditions of the various patients in a hospital prevent the playing of a phonograph. The music, while beneficial to some, is very irritating to others. This difficulty, however, is overcome by the wireless phonograph. The sending apparatus is located within a sound-tight room, located somewhere within the hospital and the attendant to operate the device has simply to start the phonograph and throw a switch. From the phonograph the music travels by wire to the wireless telephone or transmitting apparatus, from which it passes in the form of electrical waves to the sending aerial, going from this point out into space. The receiving apparatus, there being one to each bed or pair of beds in the hospital, consists of a light, sensitive telephone receiver, which is connected by a silk cord to a metal or wooden case 3 inches wide, 6 inches long and 4 inches high. The case is connected by a tiny wire to the bed post or spring, which constitutes the receiving aerial. After being released by the sending aerial the sound waves travel through space until they are caught by the receiving capacity and transmitted from this by the tiny wire to the receiving cabinet, thence along the silk cord to the telephone receiver, which is held to the ear of the patient.

There is another important feature about this device. By simply throwing a switch the wireless phonograph may be converted into a wireless telephone, thus permitting stories or newspapers to be read to the patients. The transmitting apparatus connected to the phonograph and also to the telephone consists of a group of telephone transmitters arranged in a suitable casting. The volume of sound transmitted depends entirely upon the amount of electrical energy employed, and this in turn is governed by a small rheostat.

Another use to which this phonograph may be put is in connection with large art-style cabinets within the home. In an instance of this kind the sending apparatus is located within the garage or in some distant part of the home, where the machine could be taken care of by the chauffeur or butler. After leaving the sending apparatus the sound waves are caught by the receiving device within the cabinet in the reception room, after which it continues through a two- or three-step amplifier, this to increase the volume of sound, and on by wire to a pair of telephone receivers, to which megaphones are attached. This entire mechanism is hidden by a curtain, dropped down before the front of the cabinet.

Being on the low frequency idea the waves sent out by this machine do not in any way interfere with, and neither can they be troubled by the waves of the systems now in use, nor by static. It costs not more than ten cents a day to operate this system in connection with the largest hospital or home. Where with the systems now in use thousands of volts of electricity are required, this low-frequency system may be operated by a few dry cells or a small-sized storage battery.

Before this story appears in print the hospital phonograph will be in France.

Tapping the Turpentine Tree

How the Pine Forests of the Southern States Produce Products Other Than Lumber

IN gathering its crop of turpentine, the United States draws upon almost unlimited resources. Great forests of trees steadily accumulate the sap which may be readily transformed into this valuable product. The resin which forms the supply of crude turpentine, exudes from a variety of trees, chiefly the pines. A large part of the crop is gathered from the familiar pines of the southern states. The gathering and distillation of turpentine is similar to the maple sugar industry although the value of the crop is much greater.

Few natural products are probably gathered with less labor. It is only necessary to make a slight incision in a tree trunk, and the force of gravity does the rest. The resin slowly drains from the tree and is carried away to be distilled. As recently as 1901, a very wasteful method of gathering turpentine was followed in the United States, which endangered the future of the crop. A hole was cut into the base of the tree until a cup-like cavity was formed, into which the resin drained. This method, called "boxing", did not increase the flow, but on the contrary diminished it. It inflicted a serious wound in the most vital part of the tree, weakening its vigor and lessening its power to withstand the pressure of the wind. Besides it opened the tree trunk to disease and decay, and death usually followed. The refuse resin, which dried in this cavity, made such a tree a fire trap in the dry seasons which followed, and many disastrous forest fires have been fed by such tinder.

This method of collecting the sap causes very little harm to the tree

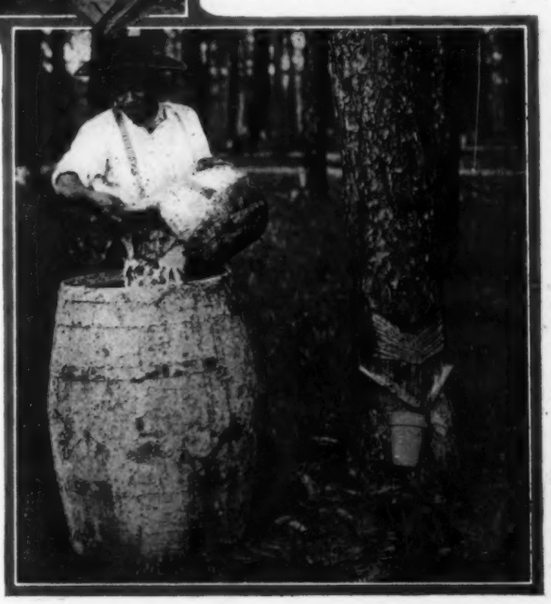
Photographs by Brown & Dawson

As a result of the work of the Bureau of Forestry a great improvement, known as the cup method, was introduced in 1901. It was found by experiment that the yield was greatly increased by this system, while the life of the tree was safeguarded. An incision is made in the tree and a cup placed to catch the drip, exactly as in gathering maple syrup. In a single year the yield of a tree was increased 23 per cent, and in another year 36 per cent. The supply had been considered inexhaustible so that the loss of trees made little difference. New ideas of conservation were gaining ground, however, and this great source of natural wealth is no longer neglected in that manner.

Slow as the method of gathering resin appears, its bulk grows at a surprising rate. From 200 acres of pine trees there is obtained the first year about 280 barrels of crude turpentine or "dip", and 70 barrels of what is known as "scrap". This crude product distills 2,000 gallons of spirits of turpentine, and 260 barrels of resin. The supply afterwards diminishes, until by the fourth year only half this quantity of turpentine and resin is obtained.

The process of distillation is comparatively simple. It is described chemically as rectifying the essential oil by distillation with water and alkaline carbonates. The colored chemist who presides over the process would probably describe it more simply. The crude product is usually distilled in copper stills. It is heated to 316 degrees Fahrenheit, which is about the boiling temperature of oil of turpentine. The crude turpentine is then washed with caustic soda after which it is redistilled.

The residue from the first distillation run through a screen to remove pieces of bark and dirt, is put into barrels and is then ready for the market as crude resin



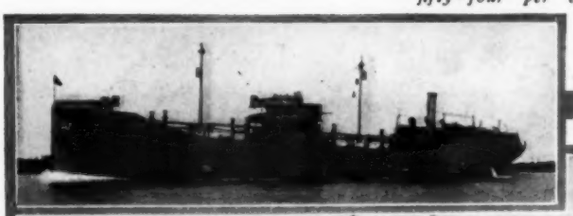
The resinous sap of the pine is led into the cup at the base of the tree from which it is collected at intervals. This is later separated into turpentine and various resin

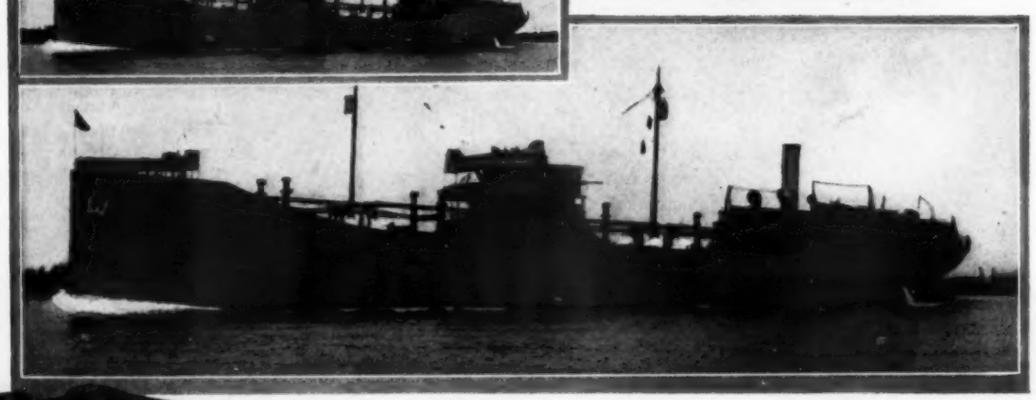
How America Has Developed

A Comparison of the Manufactures, Commerce, Mineral

Although immigration practically ceased when the war broke out in Europe, the population of the United States has increased from 97,028,000 to 105,581,000, a growth of almost nine per cent

The demand for copper has been so great that the production was speeded up from 546,645 to 843,000 long tons, an increase of fifty-four per cent





Probably the greatest advance is in the value of merchandise exported, from $2,466,000,000 to $6,231,000,000, an increase of over 152 per cent

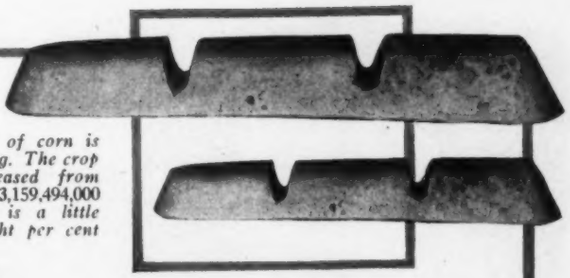
Actual figures on American shipping cannot be given at the present time, but it can be said that the percentage of exports carried in American ships has increased from 9.1 to 17.1 per cent, an increase of eighty-eight per cent

The advance in the value of imports is rather more than might be expected, from $1,813,000,000 to $2,952,000,000, an increase of sixty-three per cent

During the War Period

Production, and Wealth of the United States in 1913 and 1917

The production of corn is most encouraging. The crop has been increased from 2,466,988,000 to 3,159,494,000 bushels, which is a little over twenty-eight per cent



In the mineral resources of the country the production of aluminum shows the greatest advance; from 36,189 to 90,000 tons, an increase of 148 per cent. The production of iron ore has increased twenty-six per cent, while the iron cast into pigs showed an increase of twenty-three per cent, and the production of steel increased thirty-five per cent. The production of petroleum was increased thirty-eight per cent, while the value of all minerals produced shows an increase of 100 per cent

The demand for live stock and draft animals has increased the value of all farm animals from $5,052,000,000 to $8,264,000,000, or nearly sixty-three per cent

What has been the effect of all this prosperity on the nation's wealth? It has increased it from $187,739,000,000 to $250,000,000,000, or about thirty-three per cent

The amount of cotton consumed in domestic manufacture of all kinds has increased from 5,786,000 to 7,658,000 bales, an increase of over thirty-two per cent

Releasing Men for War Work

An up-to-date telegraph office. The message is perforated on a strip of paper that runs through the sending machine. These four machines are sending messages over one wire at the same time by the quadruplex method

THE Western Union is installing automatic telegraph machines in all of its large offices which can be operated by girls.

Experienced telegraphers are not needed for this machine; the sending is done by girls who write the message on an ordinary typewriter keyboard. The message is perforated by a series of dots on a strip of paper which resembles somewhat a music roll. This strip of paper runs through a second machine where the letters are transmitted to a receiving machine at the other end.

The receiving machine automatically writes the message on a telegraph blank by means of a typewriter mechanism. The girls with the machines, which resemble typewriters, are sending messages. The girls at the receiving machines tear off the message as soon as it is typed on the telegram form, they stamp it with the time received, and place it on the traveling belt in the center of the picture, by which it is conveyed to a general receiving station where messages are sorted and sent by a pneumatic tube system to distributing points.

Photographs by Brown & Dawson, and R. H. Moulton

Machine for distributing letters in the Chicago post office. The operator sits on a raised platform and the letters fall into boxes below

WOMEN workers for Uncle Sam will have their inning when the machine shown in the accompanying illustration is adopted for general work in all of the large cities of the United States.

A woman, by striking a key, just as she would touch a key on her writing machine, may make the correct distribution of a letter. At her touch the letter shoots into an end slot in a metallic carrier; it is held there by fingers set by a combination effected by the same touch on the key, and the carrier, carried along on an endless belt, has its fingers released by a corresponding combination permanently attached over the box to which the letter is addressed. It is dropped there face up; it passes all other boxes refusing to dump its load until right over the proper box.

The mechanical telegrapher. The receiving machine is at the left and the sending machine at the right. One having the keyboard and the other the carriage of a typewriter

So That the Blind May Read

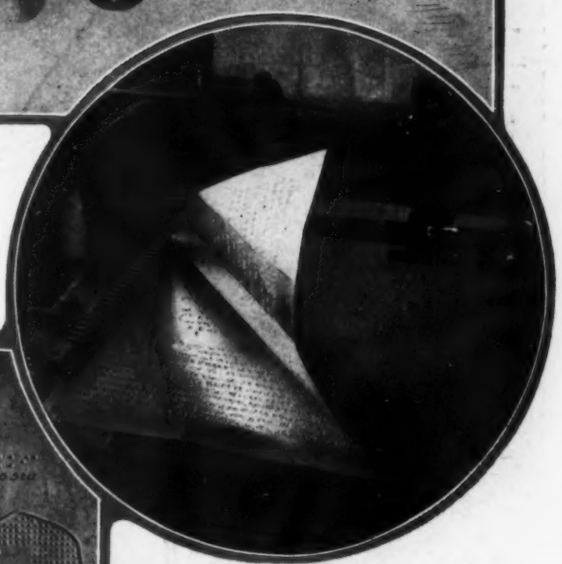
The Making of a Newspaper for the Blind Which Involves the Use of Machines and Processes Far Different from Those Used by the Ordinary Printer

IN printing newspapers for the blind, and illustrating them, several highly ingenious machines are employed. It is a much more complicated affair to produce the curious raised letters or signs than to print in the ordinary way, but the work is carried on by marvelous labor-saving devices, much the same as in a regular printing office. There are type-setting machines, typewriters, machines for producing the curious blind pictures or illustrations, and printing presses. No newspaper man or printer would feel at home, however, surrounded by this unfamiliar looking machinery.

The blind man's newspaper is not printed, of course, in any familiar sense of the word. Its letters or hieroglyphics have length, breadth and height as well, and it is this third dimension that complicates the work. It should be called a punched or pressed rather than a printed page. Every detail of the typed word, as well as the illustrations, must be raised high enough above the surface of the sheet to be distinctly felt by the sensitive fingers of the blind reader. The actual work of printing is necessarily much slower than in the case of ordinary printing. The same ingenuity which has served to save so much time and labor in turning out a newspaper has revolutionized the process in the blind man's paper office.

© Photographs by Publishers Photo Service

By the use of this writing machine it is possible for the blind to carry on a correspondence with friend



Making the copper plates from which the pages of Ziegler's Magazine are printed

and illustrations give it a somewhat unwieldy appearance, although its weight is no greater for that reason. To render the letters as distinct as possible to the fingers of its readers a special heavy paper is used.

The type-setting machine employed in such work does not, as a matter of fact, set type in the ordinary sense. It is a highly ingenious device which makes it possible to punch the letters in a sheet of copper. The machine is operated by a keyboard like a typewriter. The letters are those of the Brail alphabet, which form the A, B, C of every blind man's education. Such a type-setting machine is, of course, much simpler than the linotype, that sets the type, casts the line and redistributes the letters. It is important that the operator on the blind man's newspaper be very accurate, since a mistake in

Map of the Balkan States and the Mediterranean Sea for the blind

There is at present but one publication in America issued for blind readers, but the invention of this ingenious time-saving machinery opens great possibilities. The blind man's paper, entitled *Ziegler's Magazine*, is not for sale on the news stands, nor is it hawked about by the newsboys. It is a combination of magazine and newspaper, and has the distinction of being the only magazine which is sent through the mails free of postage. Its raised letters

A blind person "reading" a war map with both hands

a letter means the wrong shaped hole in the copper sheet, which cannot be erased. It will be noticed that the keyboard of the type-setting machine has but ten keys. This does not mean that the Brail alphabet has but ten letters. The operator presses down the keys in combination of two or more at a time, thus producing the various letters and forms of the blind alphabet.

The forms produced by the type-setting machines are produced in pairs. Later, when they are placed on the cylinder of the printing press, the two come together, exactly overlapping, so that they intermesh. Each projection fits into a corresponding aperture exactly as the two faces of an embossing stamp. One

Type-setting machine making the copper plates from which the blind man's magazine is printed

Making a map of the north polar region. This machine is used for making all the maps and diagrams

Brail alphabet. A long caption beneath the cut explains the map. Even the route followed by Peary is indicated by a line of crosses which cannot be mistaken for the other markings. These plates are mounted on the rollers of the press like the others and printed in the same way.

As might be expected the blind man's newspaper carries a large proportion of war news and illustrations. An excellent idea of the appearance of such a page is given by the accompanying photograph of the map of the Balkan States, the Mediterranean Sea, and the portions of Asia and Africa. The water area is indicated by a series of dots, while the land is left smooth. The boundaries of the various countries are made clear to the blind reader by a raised line. It will be noticed that

When printing for the blind the copper plates are mounted on the cylinders of a press and the paper fed between the plates

is in relief, the other intaglio. These copper plates which correspond to the type cylinder used in ordinary newspaper printing are locked on the cylinders of a specially constructed printing press. With each revolution of the cylinders the two copper plates of each page come together and intermesh with absolute accuracy. To print the page a sheet of manila paper is fed into the press. As it passes between the cylinders the pressure, which is considerable, forces the paper into the openings in the copper plate and a moment later comes out raised, exactly reproducing the copper plates. The raised letters have been neatly stamped into the sheet.

The printing office of the blind man's paper is full of surprises. Anyone familiar with printing offices is amazed at the wonderful cleanliness of the shop. The presses and machinery look more or less familiar, and the roar of the machinery has a friendly sound, but there the similarity ends. The transformation is due to the fact that the blind man's paper is printed without ink. The blind, of course read their alphabet by the sense of touch alone. The printing press has no ink rollers or plates. The proverbial printer's devil works with clean hands. The shop is as clean as any business office.

The blind man's paper is actually illustrated to the satisfaction of its readers. It contains maps and diagrams illustrating the text, reproduced, of course, in relief, so that it may be read by the fingers of the blind. To print such a map a copper plate or rather two of them are stamped by means of dies and the raised lines are printed exactly as the letters. An ingenious machine has been designed for the work. It consists of eight dies which when used singly or in combination produce every necessary form of raised embossing required in making these maps and diagrams. The plate for printing a full page map is shown in an accompanying illustration. The map, it will be seen, is that of the north pole regions, showing the arctic circle and the parallels of latitude with the outlines of Greenland and the northern continents. The water instead of being indicated by blue shading, as in an ordinary map, has been worked over with a series of regular projections. The boundary lines of the land is indicated by dotted lines. The arctic circle and the parallels of latitude are continuous lines which may be readily distinguished. The names of the bodies of water and of the land are printed in the

the names of all the countries and the principal bodies of water are printed in raised characters. For the sake of the ordinary reader, who may use his eyes, the names are written in ink beneath the Brail letters, but in the maps printed in the newspapers there is, of course, no such marking. The sensitive fingers of the blind can readily read such a map quickly and accurately.

In the picture showing a blind person reading such a map it will be noticed that both hands are employed. By employing the various forms of raised marks a war map may convey a great variety of information, such as the position of the battle line, the locations of armies, the position of rivers, mountains, and other natural features. This ingenious stamping machine has broadened the lives of the blind.

A modern farm tractor can ford a stream with a heavy load of hay without the slightest inconvenience or difficulty

Hills and rough roads offer no serious difficulty to the modern farm tractor with its heavy load of new mown hay

Making Hay with Kerosene

Work on the Farm Speeded Up with a Small Tractor

By L. M. Edholm

AS machinery has taken the place of hand work on the farm so is the automobile and tractor taking the place of the horse. In fact, almost every phase of the work can now be done by power-driven machinery. The plows, harrows, planting machines, reapers, and farm wagons are drawn by tractors. The portable sawmill, ensilage cutters, water pumps, churns, and threshing machines are being run by the same tractors, making it possible to operate a much larger farm with less labor.

The hot summer weather has always been a severe strain on the horses, especially during the haying, when heavily loaded wagons had to be hauled across meadows and along rough lanes to the barn. On the large farms of the West it would be impossible to plant and harvest the almost endless acres of grain without the aid of machinery.

On the moderate size farm this work is now handled by small tractors which haul a heavier load and, therefore, do the same work in less time than a team of horses. The illustration shows a tractor with a load of hay fording a stream without the slightest difficulty. The old familiar type of hay wagon that was formerly drawn by horses now acts as a trailer by shortening the pole and attaching it to the tractor.

This tractor is operated by a kerosene motor which was devised on account of the high price of gasoline. A special manifold and cylinder head is required to use this fuel with satisfaction. There are two main driving wheels of the same diameter but different width, one being 22 inches and the other 10 inches across the tire. Usually the drive is to the wide wheel only, the other being loose on the axle, but in this case provision was made so that power could be transmitted, by means of a clutch, to the narrow wheel also.

This feature is to give additional traction on rough or hilly roads, and should the idler wheel drop into a rut it is only necessary for the driver to throw in the clutch to extricate his machine.

It is not only in hauling a trailer that the small tractor is useful on the average farm. It will pull a plow or other farm implement better than a team of horses. When not being used for hauling it can be belted to any of the numerous labor-saving machines that are to be found on the well-equipped, modern farm. Even during the winter a tractor need not be idle, it can be used to cut the year's supply of wood or even to run a portable sawmill and get out the lumber for fences, new buildings, and other purposes.

Waterways to Supplant Railways

A Fund Provided Which Will Permit the Government to Rebuild and Develop the Inland Waterways and Canals—Washington May Also Buy, Build, and Operate Motor Barges and Other Transportation Facilities

By S. A. Thompson

ANYTHING more thoroughly mixed than the waterway situation, at the time these lines are written, would be hard to find. On the one hand the optimist can find facts which justify him in throwing up his hat and shouting; and on the other the pessimist can find abundant reasons for drawing down the corners of his mouth and groaning in despair. The truth, no doubt, lies somewhere between the two extremes, but its exact location is decidedly hard to determine. Perhaps the best thing that can be done is to hear what both sides have to say, and we will give the optimists their innings first.

To begin with, the Confirmed Optimist points to the undoubted fact that for nearly two years past the railways have been entirely unable to meet the transportation needs of the country, can not do it now, and will certainly become less, rather than more, able to do so as we get deeper and deeper into the war. As the traffic must be moved if the war is to be won, this means that not only the railways but the highways and the waterways must be used to the limit of their capacity.

As originally introduced, the bill to regulate the "operation of transportation systems while under government control" authorized a revolving fund of $500,000,000 with which to provide engines, cars, etc., for railroads which lacked funds to do this for themselves, but made no mention of waterways. This omission was remedied, however, before the bill was reported from the committee, and the new paragraph is in the bill as passed. Authorities differ as to whether, under this paragraph, the President could build an entirely new canal, but there is no question that he, or Mr. McAdoo acting under his authority, can use any part or all of the $500,000,000 in the revolving fund to take control of canals or other waterways and to lease, buy or build, and operate boats, barges, and other transportation facilities on the "coastwise and inland waterways of the United States."

To the writer it seems unfortunate that Mr. McAdoo was not made Director General of Transportation and given control of every form of transportation, instead of being called, as he is, Director General of Railroads. However, he did not overlook the paragraph that has been mentioned and, as soon as he had got his big railroad machine to moving, he appointed a Committee on Inland Waterways, consisting of Maj. Gen. Wm. M. Black, Chief of Engineers, Chairman; Brig. Gen. Chas. Keller, Secretary; G. A. Tomlinson, of Duluth; Walter S. Dickey, of Kansas City; M. J. Sanders, of New Orleans; and Calvin Tomkins, of New York City.

It was made the duty of this committee to make investigations and recommendations looking to the development and utilization of water transportation and to the complete cooperation and coordination of railways and waterways. The committee lost no time in getting busy and the first notable result of its work was the taking over by the Director General of Railroads of the New York Barge Canal system and the appointment by him of a member of the committee, G. A. Tomlinson, of Duluth, as manager. Fifteen power boats and 160 barges of the old canal type have been leased and are already in operation and this number will undoubtedly be considerably increased before these lines are printed, for it is the intention of Manager Tomlinson to put everything available into service.

In addition to using every available boat of the old type, fifty-one steel, and twenty concrete barges are to be built as soon as possible and it is hoped that deliveries will begin in August. These barges, none of which will have power, are to be 150 feet long, 21 feet beam, and 12 feet molded depth. Three of these barges and a power boat of the same size can be passed through the locks at one time. The steel barges, which will cost in the neighborhood of $60,000 each, will have a capacity of about 600 tons, while that of the concrete barges will be some twenty-five per cent. less. But they will also cost less and can be built in less time.

It is unfortunate that sufficient boats and barges are not ready to use the New York Barge Canals to their ultimate limit of capacity during the present year, but it seems pretty certain that every boat and barge that can be bought, or leased or built will be kept busy until it is stopped by the ice, since, for the first time in many long and weary years, the New York Canals, and waterways in general, are to have the cooperation, instead of the continuous and vindictive opposition, of railways. The New York Canals will also have the protection of recent legislation greatly extending the powers of the Public Service Commission and the benefit of through routes and joint rates in connection with steamship lines on the Great Lakes.

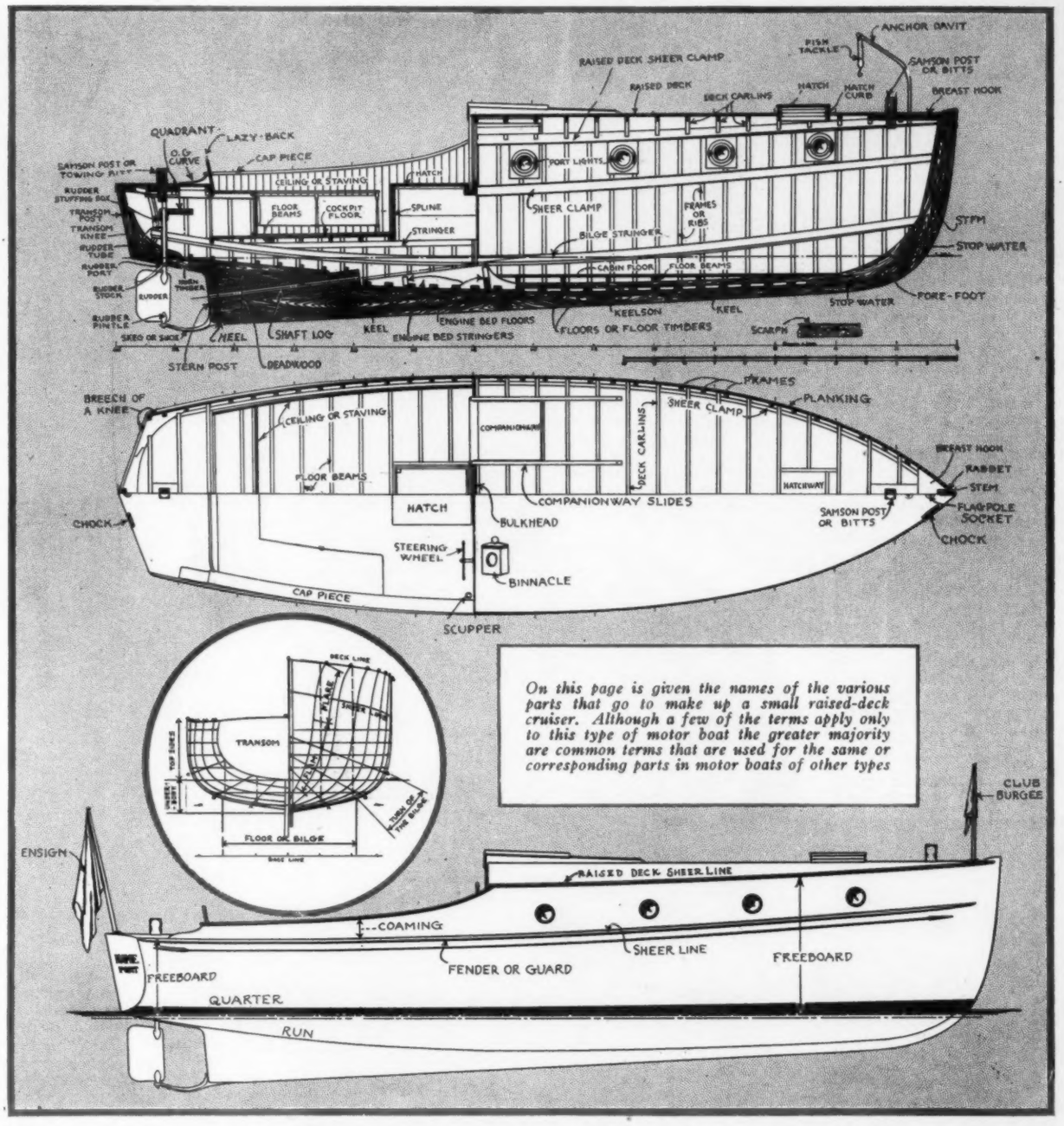
The Committee on Inland Waterways has made reports on the lower Mississippi River and on the Black Warrior River in Alabama, which gives the great coal and iron region about Birmingham an outlet to the sea at Mobile. The Committee, of course, will make

(*Continued on page 72*)

Motor cars being transported from Cincinnati to Memphis. Three barges and 179 automobiles are pushed along by one old fashioned stern-wheeler

From Keel to Companionway

Can You Name All the Parts That Enter Into the Construction of Your Cruiser?



On this page is given the names of the various parts that go to make up a small raised-deck cruiser. Although a few of the terms apply only to this type of motor boat the greater majority are common terms that are used for the same or corresponding parts in motor boats of other types

HAVE you ever tried to tell some old timer about some particular part of your boat and been embarrassed by not knowing its proper name? Most of the technical terms and the names of the various parts of a vessel have been handed down from one generation to another from the days of the full rigged ship, or even earlier. The origin of most of the terms is hard to trace. Some still have the same meaning while others have undergone a gradual change until today they are applied in an entirely different sense.

The word launch is generally accepted today to mean a small boat propelled by some mechanical device whereas it was originally applied to a large boat carried by sea-going vessels and sometimes referred to as the long boat. On sailing yachts the old terms still apply to many of the parts but with the development of the motor boat has come new terms that are more appropriate as raised deck, motor compartment, military mast, etc.

Sailing vessels and a few of the older steamships still have catheads, heavy timbers projecting from the bow by which the anchor is hauled aboard, and to which it is secured when not in use. On modern ships the shank of the stockless anchor, now in almost universal use, is drawn up into the hawse pipe with only the flukes projecting from the hawse hole or the entire anchor is lifted and placed on deck by means of the fish tackle on an anchor davit.

In planking a hull, that plank next the keel is called the garboard and the one immediately below the sheerline is called the sheer strake, and if the planking is put on starting from both the garboard and sheer strake the last planks put in place are called shutters. In planking a deck that plank along the edge that follows the curve of the sides is called a cover board. The term bulwarks is applied to that part of the sides of a vessel which are carried above the main deck but in a motor boat it is generally called the coaming.

Then again, the same object will be given a different name in different localities. Down along the Maine coast the fishermen call a nine-thread rope, or in fact any small rope, a rode; their home-made wooden anchors weighted with a stone are termed killicks, and a sea anchor is a drogue.

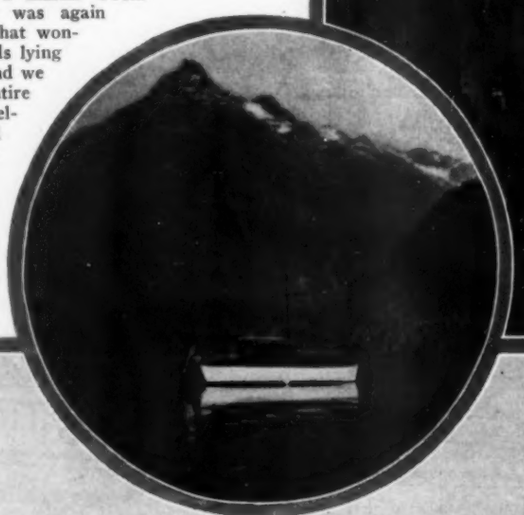
In the same way different types of boats have been developed to suit local conditions as the oyster canoes of the Chesapeake Bay that are built by fastening together five or six large squared timbers and then working out the hull in the same manner as the Indians made their dugouts. The other extreme to this is probably the Hampton boats of the Casco Bay fishermen. These boats are built of 1-inch strips of white pine, each one beveled to conform to its neighbors, and all strongly nailed together. They are built about a mold and have no frames except the stem, keel, and stern post. They were originally built as sailing boats but many are now motor driven.

In the Land of Never-

A Cruise on the Inland Waters of Washington and British Columbia

THE beautiful inland waters of Washington and British Columbia present such a vast field for choice in the selection of a vacation cruise that the yachtsman of the Puget Sound country finds real perplexity in deciding upon the spot he will visit. The decision of Mr. and Mrs. L. A. Jacox, of Seattle, Wash., with their Glorybe, and Mrs. Whitacre and myself with our Elizabeth Ann, was upon Jerves Inlet, one of the numerous narrow inlets that extend into the mountainous mainland of British Columbia at a point about forty miles above Vancouver and an equal distance above Nanaimo on Vancouver Island. F. Austen, of Portland, accompanied Mr. and Mrs. Jacox.

Every mile of the journey from Tacoma to Victoria was full of interest. The scenery became progressively more rugged; Deception Pass, with its boiling waters, gave us a real thrill; and the San Juan Islands seemed to have a new charm. From Victoria to Nanaimo the cruise was again through narrow passages, among that wonderful group of mountainous islands lying to the east of Vancouver Island, and we felt that we should spend the entire three weeks drinking in the marvelous beauties of the land-locked nay, mountain-locked bays and harbors that abound. Maple Bay is beautiful, Montague Harbor is a veritable treasure house for the artist, and for the lover of rugged wildness Gabriola Pass has some beautiful nooks and corners, the Pender Islands have their special charm, indeed there are dozens of coves that bid one cast anchor and sit in silent contemplation. It seems a sacrilege to speed up the engine on any part of the trip through these islands.



Mt. Victoria (7,445 feet) on Jerves Inlet

Pender Harbor is a fitting introduction to the rugged beauty of Jerves Inlet and it would seem a pity for anybody making this trip to miss the peace and joy of one or two nights' anchorage in these peaceful waters. The promontories and islands which give it its labyrinthian form are rugged and wild, and Mt. Arthur rising 1,500 feet from the water's edge, seems very

Vancouver Bay, Jerves Inlet, an anchorage completely surrounded by rugged mountains

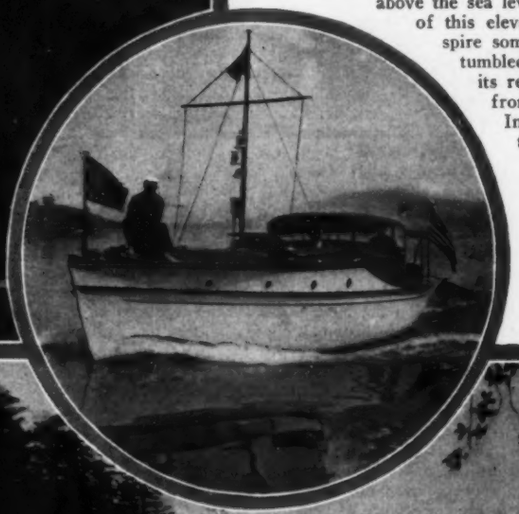
Ending Charms

By H. J. Whitacre

rewarded for the trip by this scenery, but were at a loss for words to express our wonder when we got to Vancouver Bay, about one-half the length of the inlet, and cast anchor in the very midst, nay, under the very dome, of mountains ranging from 5,000 to 6,000 feet high. Rugged mountains were all about us and a gap here and there gave us more distant views of snow fields and even higher mountains.

But this was not all. The afternoon cruise of twenty-five miles was through a narrow, deep valley between two snow-covered mountain ranges of increasing altitude, and the climax in this wonderland was reached only when we cast anchor at the very head of the Inlet.

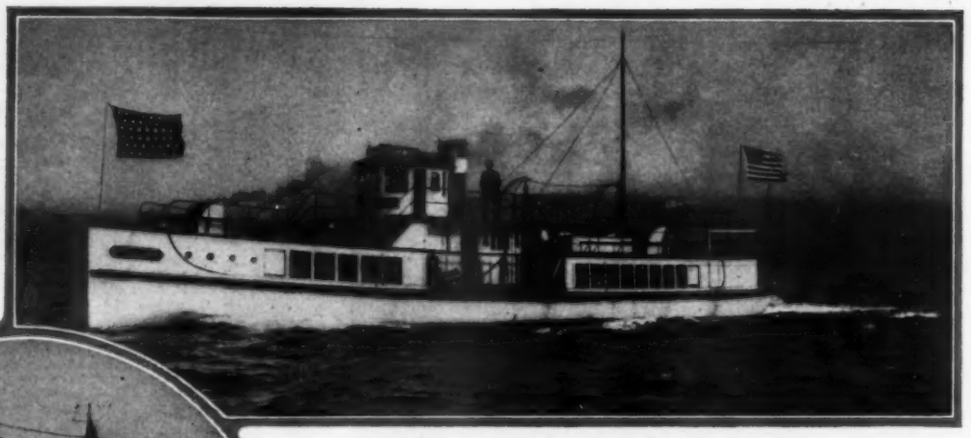
We usually view a mountain that measures 6,000 or 8,000 feet in elevation from a point that is 1,000 feet or more above the sea level, or the high point of a mountain of this elevation is nothing more than a rocky spire somewhat higher than the surrounding tumbled mass and we are not impressed with its real altitude. There is no subtraction from the altitude measurement in Jerves Inlet. Here there are a dozen mountains ranging from 5,000 to 8,450 feet in height, that rise so abruptly from the very water's edge that in many instances a perpendicular dropped from the apex of the mountain would strike sea level at a point



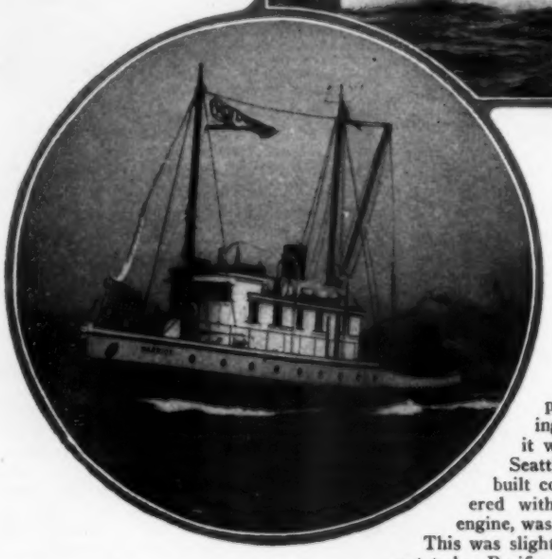
The Glorybe, in Spieden Channel, San Juan Islands

high and picturesque at this stage of the journey. Jerves Inlet is a narrow canal, varying from one to one and one-half miles broad, which follows a tortuous course from Malaspina Straits for fifty miles into the very heart of the Coast Range of mountains. From the outset the shores are rocky and perpendicular, then the land elevation becomes progressively greater and the entire country more ruggedly mountainous as the cruise continues toward the head of the inlet. Picturesquely broken, timbered slopes rise at an angle of 45 degrees to 70 degrees from the water's edge and attain an altitude of from 2,000 to 4,000 feet along the lower half of the Inlet. We thought we were amply

Smugglers Cove, Matia Island, one of the most beautiful spots in the San Juan group



The two pioneer Diesel boats of the Pacific Coast, both built on the coast and powered with American-built motors. The cannery tender Warrior went into commission about two months earlier than the passenger boat Suquamish



The Heavy Oil Motor

The Commercial Boats of the Pacific Take Advantage of the Motors That Operate on the Cheaper Grades of Fuel

IV—THE DIESEL-POWERED MOTOR BOATS

By A. V. Comings

IN my previous articles of this series in MOTOR BOATING I have tried to show as clearly as possible the development of Pacific Coast types of commercial motor boats powered with engines using gasoline or distillate as fuel. The real development in boats of this type spanned but a comparatively few short years. From the one-cylindered fishing boat to the hundred-foot halibut schooners or the still larger oil tankers was not a big jump in point of time, though a wonderful achievement measured by the progress it typified in internal combustion motor development. The tremendous demand found a ready supply from the engine manufacturers, the designers, and the boat builders, and the result was a fleet that has taken first rank by a wide margin over the commercial motor fleets of all the world.

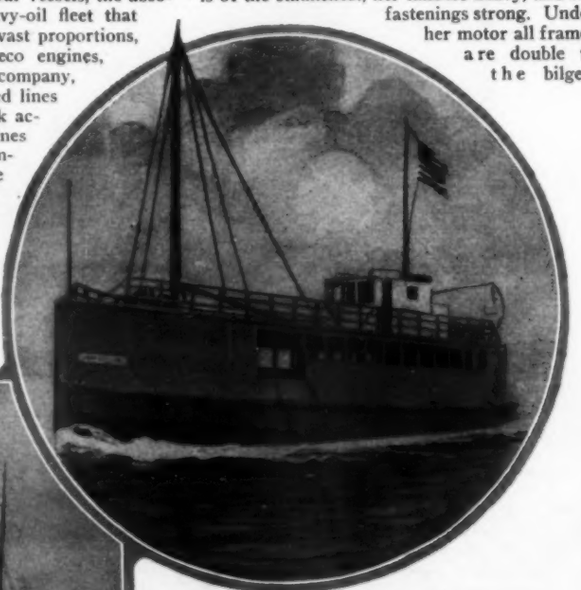
Now comes another epoch in Pacific Coast commercial motor boating history, and again the commercial motor boats and ships of the Pacific Coast leap to the front rank by a wide margin in this half of the world, if not in the entire world's fleets. It is the epoch of the heavy-oil engined motor boat, the ships that are propelled by so-called Diesel and semi-Diesel engines. Engines of this type, using a low grade fuel oil that costs but a few cents per gallon, are revolutionizing the shipping industry. And it was on the Pacific Coast, at Seattle, that the first American-built commercial motor boat, powered with an American-built Diesel engine, was launched February 28, 1914.

This was slightly over four years ago, and yet today Pacific Coast shipyards are turning out great Diesel-powered merchant ships, whose tonnage runs into the thousands just as fast as workmen can put the hulls together. And the fleet of Pacific Coast Diesel-powered ships already built searches out far ports in many seas. It is an almost inconceivable accomplishment in the short span of four years.

To the New London Ship & Engine Co., of Groton, Conn., belongs the credit for much of the earlier success of the Diesel engine on the Pacific Coast. The first four vessels, the absolute pioneers, in the heavy-oil fleet that has since grown to such vast proportions, were powered with Nlseco engines, manufactured by this company, and their success in varied lines paved the way for a quick acceptance of heavy-oil engines on the part of vessel owners in every city on the Coast. The performance of these first four vessels was watched with the keenest interest by the shipping fraternity, and once their success was proved there was no hesitancy in placing more orders than the heavy-oil engine manufacturers could supply.

Arthur E. Fuller, now sales manager of the New London Ship & Engine Company, was in charge of the early installations and development work on Puget Sound and had a large part in showing the shipping world that the Diesel engine had arrived for a permanent stay.

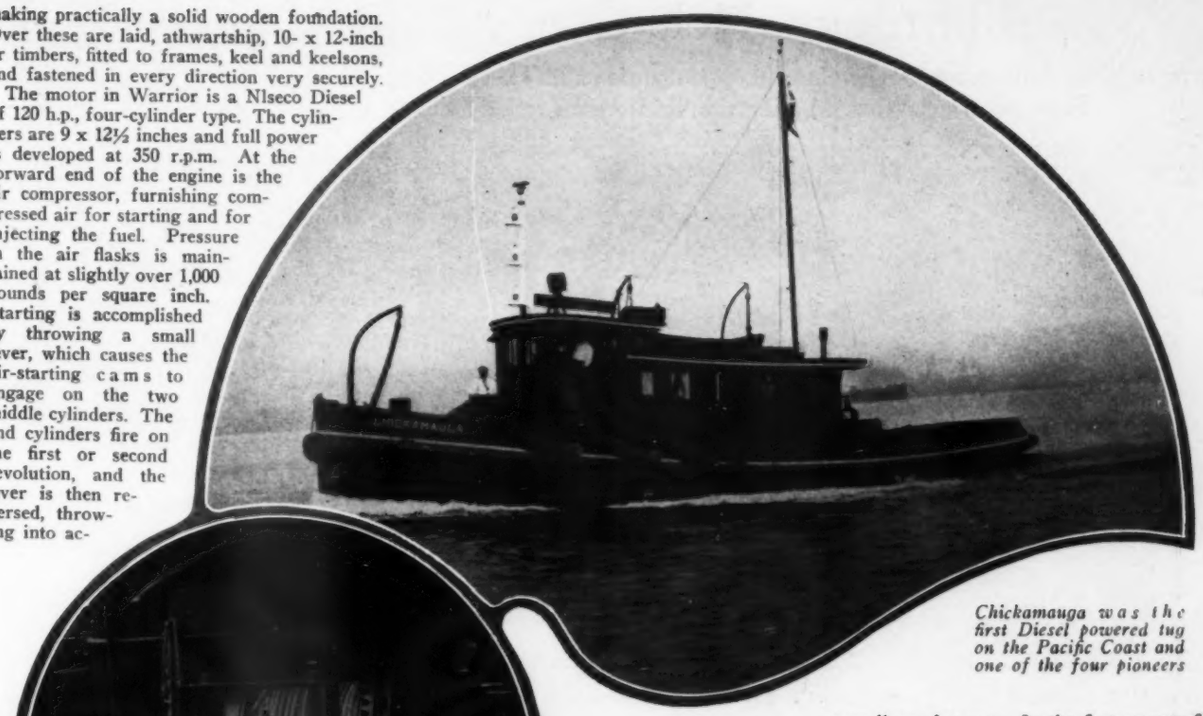
The salmon fishing industry, naturally, was first to see the economy of the Diesel-powered vessel in the larger sizes, and the first Diesel-powered vessel was a cannery tender, Warrior. Designed by L. E. Geary, of Seattle. Warrior embodied all the features that had proved successful in the smaller gas-engine propelled vessels of the same type. She is a 97½-ton boat, 87 feet long, of 17 feet beam, and drawing 7 feet 3 inches. Her construction throughout is of the staunchest, her timbers heavy, and her fastenings strong. Under her motor all frames are double to the bilges,



The freighter Amazon was one of the first semi-Diesel powered vessels, and the tug Marie Hanlon was converted from steam to oil with a Bolinders motor. The latter is shown towing the Manga Reva into San Francisco Bay

making practically a solid wooden foundation. Over these are laid, athwartship, 10- x 12-inch fir timbers, fitted to frames, keel and keelsons, and fastened in every direction very securely.

The motor in Warrior is a Nlseco Diesel of 120 h.p., four-cylinder type. The cylinders are 9 x 12½ inches and full power is developed at 350 r.p.m. At the forward end of the engine is the air compressor, furnishing compressed air for starting and for injecting the fuel. Pressure in the air flasks is maintained at slightly over 1,000 pounds per square inch. Starting is accomplished by throwing a small lever, which causes the air-starting cams to engage on the two middle cylinders. The end cylinders fire on the first or second revolution, and the lever is then reversed, throwing into action the regular operating cams on the two center cylinders.



Chickamauga was the first Diesel powered tug on the Pacific Coast and one of the four pioneers

Chickamauga is equipped with a towing machine operated from the main shaft and using a spring to ease the strain when towing

Fuel is supplied to the cylinders by a small fuel pump on the after end of the motor and lubrication is secured with two large Detroit force feed lubricators and several grease cups.

Reversing is accomplished by means of a large reverse gear, operating between the rear flywheel and the tail shaft.

The motor complete with flywheel, clutch, and thrust bearing weighs approximately 16,500 pounds.

In addition to the main engine in Warrior's engine-room there is a 10 h.p. four-cylinder Kermath motor, running on gasoline and driving a 3 K.W. 110-volt dynamo for lighting, a rotary bilge pump, and an auxiliary air compressor.

A 9 h.p. Fairbanks hoisting engine is mounted on the after deck of Warrior for brailing, etc.

Warrior worked seven months the first year it went into service, doing all the hard, gruelling work that a cannery tender in Bering Sea has to do during the salmon fishing season.

Eleven thousand miles were traversed in 1,658 hours of running time, and during much of that time Warrior was towing huge scows or pile drivers. This work was done at a net expense for fuel of $214, and for lubricating oil of $80. Comparing this with what it would cost to run a distillate driven cannery tender the same number of hours, or a steam outfit, shows an immense saving over those types.

The next Diesel-engined craft to slip down the ways was Suquamish, a smart little passenger vessel designed by Messrs. Lee & Brinton, of Seattle, for the Kitsap County Transportation Company, for use on a fast run from Seattle around Bainbridge Island, a residence district fast building up and requiring modern transportation facilities, especially in summer.

Suquamish was launched April 23, 1914; the first Diesel-engined passenger vessel in the United States. She is 92 feet long, of 16 feet beam, and draws 5 feet. Passenger accommodations fore and aft in well appointed cabins and on a roomy upper deck care for 180 passengers comfortably. Wheel-house amidships, with stack just abaft it, give Suquamish a decidedly smart appearance, and though the boat was the first of her class, Messrs. Lee & Brinton gave such intelligent thought and care to her designing that she combines speed, large accommodations, and safety, with a rare grace in appearance.

Suquamish is powered with a Nlseco engine rated at 180 h.p., but which has developed 210 h.p. when pushed. At normal r.p.m. the motor drives Suquamish at 15 m.p.h. On one of her earliest tests Suquamish took the Bainbridge Island run, 32 miles, making it in 2 hours, and consuming 18 gallons of fuel oil at 2¼ cents per gallon. This made the trip cost approximately 44 cents. During the season of 1915 Suquamish ran 24,300 miles, a distance almost as far as around the world, at a total fuel cost of $325.13. For the same time her lubricating oil cost $173.24.

The motor in Suquamish is of the six-cylinder, four-cycle type built by the Nlseco company, embodies many of their more important improvements, and has pointed the way to further use of Diesel power on passenger craft in inland waters.

Third in the list of the Diesel pioneers on the Pacific Coast came another craft of a different type. This time it was a heavy tug boat, Chickamauga, designed by L. E. Geary for the Pacific Towboat Company. This immediately gave the steam towboat men a chance for a comparison, and their eyes were opened by the figures a season's work of the Chickamauga showed them.

Chickamauga is 75 feet long, 18 feet beam, and draws 10 feet. Her power is a 240 h.p. Nlseco Diesel, and her owners claim she is the best towing boat of her size on Puget Sound, regardless of power. In the first seventy-five working days that she went into service Chickamauga towed 662 hours and ran light 188 hours, consuming 7,725 gallons of fuel oil at a total cost of $167.79, surely a remarkable record for a tugboat of her size.

Not only is Chickamauga the first Diesel-engined tugboat in America, but she is also the first tugboat driven by an internal combustion motor to be fitted with a bonafide towing machine. Old steam-tug boatmen have always maintained that the motor towing boat could never be as successful in handling heavy loads, heaving in towing hawsers, etc., as the steam tug, because it would lack the steam towing machine that facilitates these operations on steam tugboats.

On Chickamauga, the towing drum aft of the deck house is geared to the tail shaft below and operated by a clutch controlled from the deck beside the towing machine. This handles the steel towing cable perfectly, and for easing the strain on the cable in a seaway or under any conditions where the ordinary hitch to towing bitts would be dangerous the pull is taken by a steel cable led part way around the periphery of the towing drum, terminating in a hook on the upper end which engages in a hole in the drum and passing at its lower end through a heavy coiled spring, contained in a vertical pipe below decks, the spring being compressed or expanded as the towing cable strains on the drum or eases up its pull. This device has been found to perform all the functions that have been performed in the past by the steam towing machines used on steam-tugs, and is a happy solution of the problem for gas boats.

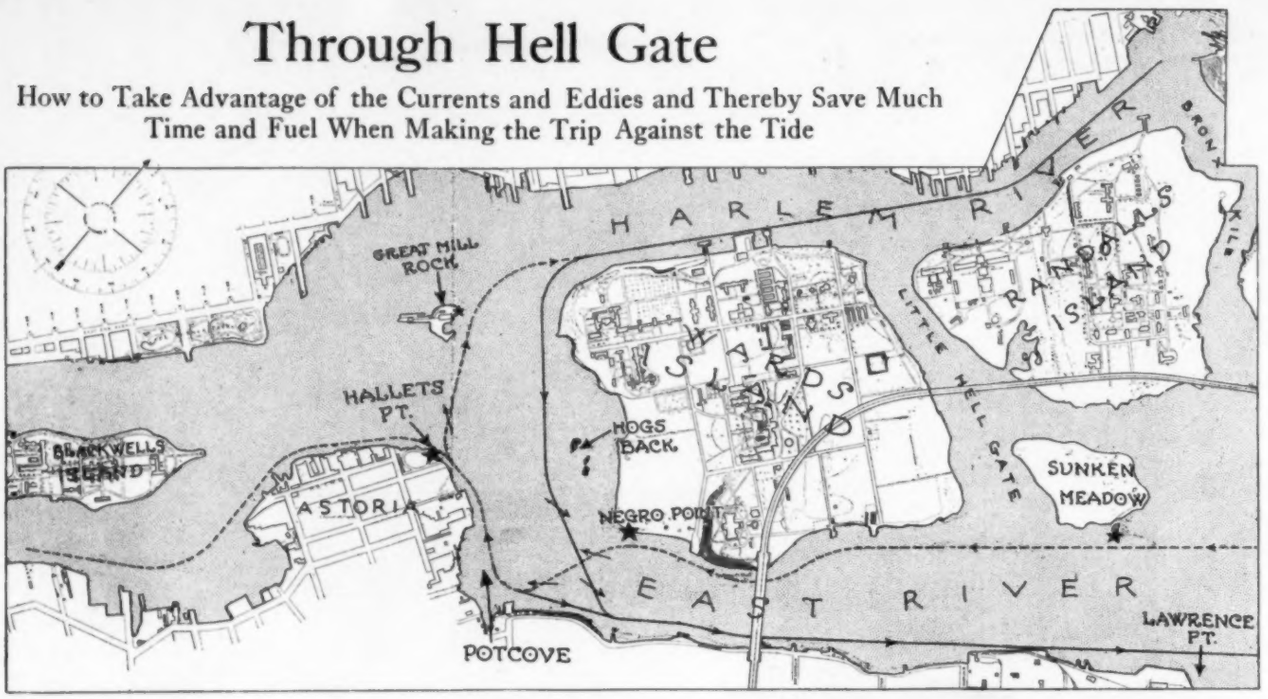
The fourth of the Diesel pioneers was the cannery tender Chomley, which has, from the day it was launched, given splendid service. She ended her first season in Alaskan waters by reeling off a non-stop run of 754 miles from Ketchikan to Seattle, arriving there fit to turn about and complete the round trip without an adjustment.

While these Diesel installations were being made on Puget Sound, manufacturers of the so-called semi-Diesel type of motor, using heavy fuel oil at low compressions, and igniting by means of some type of sustained heat unit within the cylinder head, were not idle. One of the first of this type of installations was made in Amazon, a freight boat operated on the Seattle-Tacoma route by the Lillico Launch and Tow Boat Co., of Seattle. This boat was designed by Geary and is 65 feet

(*Continued on page* 98)

Through Hell Gate

How to Take Advantage of the Currents and Eddies and Thereby Save Much Time and Fuel When Making the Trip Against the Tide



Part of U. S. Coast and Geodetic Survey chart No. 369[5] showing the courses to be followed when going through Hell Gate against the tide to avoid the strong currents

WITHOUT question, the finest body of water on the Atlantic Coast for either sailing or motor boating, is Long Island Sound, but unfortunately, the western end of the Sound terminates in the East River—and Hell Gate—and yachtsmen cruising from west or south of New York must take their craft through the Gate to reach the Sound.

There was a time, forty years or more back, when Hell Gate probably lived up to its name and reputation, but about all that is left is the name. True, the water rushes through the narrow channel at high speed (given on the chart as 6 knots), but the dangerous rocks have long since been removed. No motor boat owner need fear the trip through the Gate. It never requires over twenty minutes, and often not half that.

Some men think it necessary to wait and go through with the tide, or spend from two to three hours bucking the current. An eight-mile boat can easily put in two hours making the trip against the tide, but it is an unwarranted waste of gasoline and time. The water through the Gate is deep, from 20 to 140 feet, not only in the middle but near the shore; and as may be expected the swiftest current, with two exceptions, is near the center. These two exceptions occur at Hallet's Point and Negro Point. Also, there are places where the formation of the land causes eddys, and these should be taken advantage of.

When coming in from Long Island Sound against the tide the course should be laid from the channel between North Brother and South Brother Islands to the light off the Sunken Meadows. When off the light head for the masonry tower at the North end of the Hell Gate arch bridge on the shore of Wards Island. This will bring you in close to Wards Island, but there is about 10 feet of water up to the dock and about 28 feet at a distance of 20 yards off the shore under the bridge, so that a motor boat not drawing over four feet can keep well in shore out of the current.

After rounding Negro Bluff (just west of the bridge) the water is not so deep, and it is well to keep about 40 yards off shore. When you have the light on Negro Point abeam you will begin to feel the effect of the current. By holding the same course (indicated by the arrow) the current will carry the boat across the river to Pot Cove. Once across, there is an eddy, and slack water, almost up to the light on Hallet's Point.

If bound down the East River to New York Harbor it is best to keep close in shore when rounding Hallet's Point. There is a depth of about 25 feet almost up to the sea wall, so there is no danger of grounding, and the current between Blackwells Island and the Long Island shore is much less than in the channel between Manhattan and Blackwells Islands.

If the trip is to be made through the Harlem River to the Hudson it is well to keep close inshore until Hallet's Point Light is abeam and then make for the east end of Great Mill Rock. In crossing from Hallet's Point to Great Mill Rock it is necessary to head well to the west, in fact, almost to the park on Horns Hook, on the Manhattan shore at 89th St. Once at Great Mill Rock the strong current is not again encountered.

Great Mill Rock is quite a sizable island and is occupied by a Government storehouse of the United States Engineering Department, a substantial concrete and terra cotta structure used by the engineers engaged in the river and harbor improvement work. The water is about 14 feet deep almost up to the shore, so that it is safe to run in close and avoid the strong current.

When opposite Great Mill Rock an easy swing should be taken into the Harlem River. The water is rather shallow along Wards Island, so that it is well to keep the Wards Island docks open of those on Manhattan at 118th and 119th Sts.

There is very little current from Great Mill Rock to Little Hell Gate (between Wards and Randalls Islands) and practically none from there to the first bridge, at Willis Ave., but from this point on there is quite a strong current, reaching a maximum at High Bridge between the masonry piers.

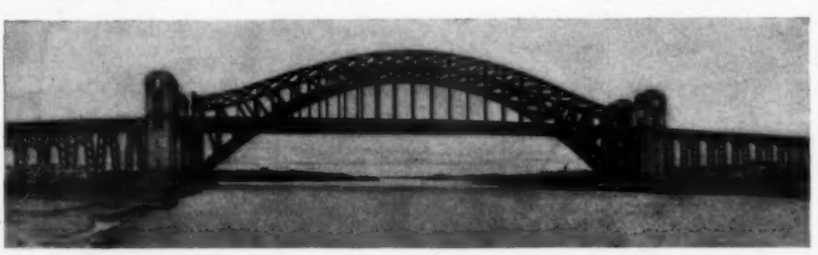
When bound east against the tide, to the Sound from the East River, the same course is followed around Hallet's Point to Pot Cove as when westward bound. When coming from the Harlem River it is well to keep about 50 yards off Wards Island, heading for about the center of the low bluff just east of Pot Cove until past Hogs Back and nearly abeam of Negro Point Light. At this point the strength of the current is very noticeable, and the course should be laid for about the center of the main arch of the Hell Gate bridge as indicated by the arrow. This will carry you across the river to the Astoria shore, which should be followed to the east end of the dock at the works of the Consolidated Gas Company.

When once past the first dock, don't try to follow the bulkhead to Lawrence Point. Lay your course for the black spar buoy just beyond the point, and keep well off the bulkhead. It looks like a dock, but the water is very shallow and the bottom is strewn with boulders of various sizes. Do not attempt to run inside (east) of the line of black buoys from Lawrence Point to South Brother and Rikers Islands. The water is very shallow and full of mud flats. The channel leading into Flushing Bay is clearly marked with buoys, but no shortcuts can be taken.

When going through Hell Gate in either direction with the tide the best time is made by keeping near the center of the river, except that the strength of the current sets in quite close to Hallet's Point, and from there to the channel between Blackwells and Manhattan Islands.

We will admit that the Gate has a bad reputation, but mostly among boatmen who have not made the trip, or those who have once or twice spent an hour

(*Continued on page 70*)



Hell Gate Arch Bridge from the west. Although this is the narrowest part of the East River, the current is not as strong as off Negro Point

Is Your Propeller Suited to Your Boat?

There Are Other Factors Than Diameter and Pitch to Be Considered When Choosing a Propeller for Any Particular Combination of Hull and Motor

SELECTING the proper propeller for any given combination of hull and motor is undoubtedly the hardest problem in power plant design. It is one of those things that simply cannot be worked out by rule or formula, and the closest approximation is that of previous experience with similar conditions. I say "closest approximation" because of the fact that unless two boats are built from the same plans *throughout* the conditions will not be the same, and even then there will be minor differences that will affect the performance to some slight extent.

The speed maniac may just as well stop right here as the following discussion does not include speed boats, whether called racers, runabouts, or express cruisers; or the overpowered boat of ordinary design.

As the diameter, pitch, and blade width are quantities that cannot be directly computed for any fixed conditions, an analysis of the action of a propeller and its effect on the water in which it works may serve as a guide in choosing a wheel for any particular craft.

There are several general rules that apply to any efficient propeller, whatever the shape or the number of blades. In the first place it must pass the water astern, not throw it to the sides. The pitch must be constant from the tip of the blade to the hub, or some part of the blade will act as a drag on the boat.

The action of a propeller in motion is to pass a column of water sternward. The diameter of the column is slightly greater than that of the wheel, and the length of the column

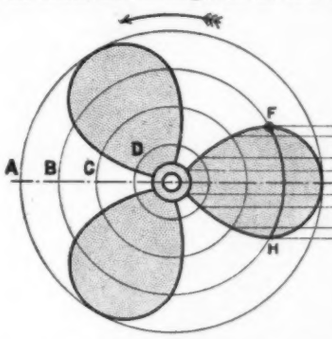


Fig. 2—In a true pitch wheel every part of the driving surface must conform to a helix. Thus every point on the line FH must lay in the helix developed by the point F

is theoretically equal to the pitch of the wheel for every revolution it turns—actually it is a little less. The velocity of this column of water in relation to the water at rest is termed the "real slip." It is the reaction of the force exerted to overcome the inertia of this column of water that drives the boat ahead. As inertia is directly proportionate to the mass, it is evident that the larger the diameter of the column of water—and the diameter of the wheel—the greater will be the reaction, or the force tending to give the boat the forward motion through the water.

Fig. 1 is intended to represent a three-bladed propeller and the theoretical column of water it will pass astern. The path of the tip of one of the blades is indicated by the curved line, or helix, A^1-A. If possible, imagine this column of water enveloped in a paper cylinder and the path of the tip of the propeller blade traced along the paper. If that portion of the paper cylinder passed in one revolution was then cut open and rolled out flat we would find that the path of the propeller blade was a straight line, as the line A-A^1 in Fig. 3. The angle that the line A-A^1 makes with the axis of the wheel is the angle that the tip of the blade *should* make with the shaft.

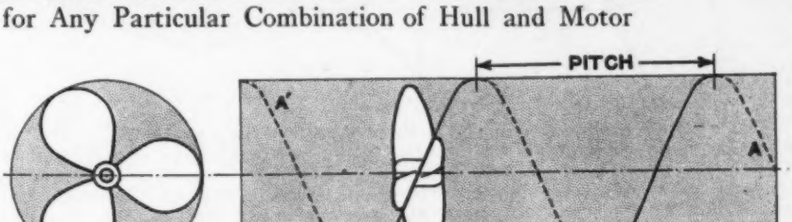


Fig. 1—In action a propeller passes astern a column of water slightly larger in diameter than the wheel

If in the same way the path of other points on the blade of the wheel are traced on cylinders, as B, C, and D, in Fig. 2, and the cylinders then developed, or rolled out flat,

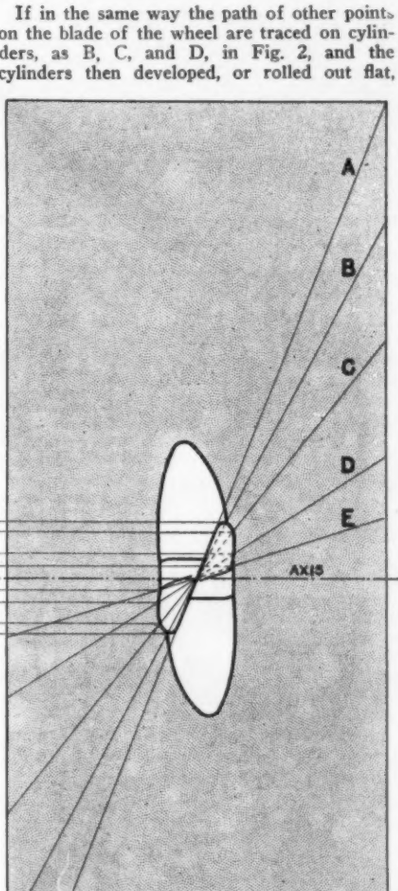
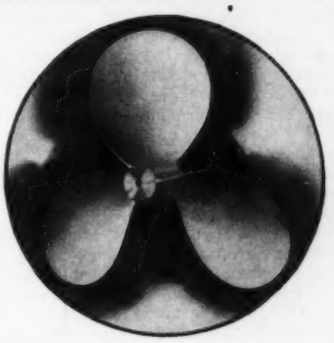


Fig. 3—When developed it will be found that the helix for any part of the blade will be a straight line, but that the angle with the axis will vary with the distance from the center

it will be found that they too are straight lines, but making much smaller angles with the axis of the wheel.

The lines A, B, C, and D in Fig. 3 are on the driving face of the blade—the one that pushes against the water—and E is the intersection of the face with the hub, as the lines A, B, C, D, and E are the directions in which the various portions of the blade travel, it is evident that to pass through the water with the least resistance every point on the driving



For general use on medium speed boats the broad, oval-bladed propeller gives best results

surface must coincide with the helix developed by the point on the edge of the blade that is the same distance out from the axis. Thus, every point on the line FH, in Fig. 2, must lay in the helix developed by the point F. A wheel that meets this requirement is said to be a true pitch or true screw propeller.

To turn with the least loss of power the blades must be as thin as is consistent with the strength of the material used, the edges must be sharp and to avoid excessive skin friction the surfaces must be ground smooth and polished. A very flat half-oval section, as shown in Fig. 5 comes nearest to fulfilling all the requirements.

The power of a motor is generally given in horsepower, but there is another measure of power that is sometimes more useful, that is the torque, or in other words, the force tending to rotate the shaft. Torque is always expressed in the terms of foot-pounds or inch-pounds. That is, the force in pounds developed at a distance of 1-foot or 1-inch from the center of the shaft. The force in pounds at any

A wheel of this shape will cut through weeds and eel grass without winding it around the shaft

distance from the center of the shaft is easily found by dividing the torque by the distance. Torque in foot-pounds is computed from the horsepower by the following formula:

$$T = \frac{\text{H.P.} \times 33{,}000}{\text{R.P.M.} \times 6.2832}$$

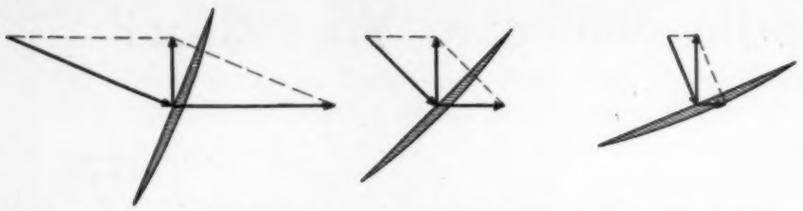


Fig. 5—Other things being equal, the thrust depends entirely on the pitch. But when the pitch is changed the two other factors also change. The three must balance.

As can readily be seen from the torque formula, with the revolutions per minute in the divisor, the greater the revolutions per minute, the less the torque. In other words, the slower a motor turns to develop a given amount of power, the greater the torque.

It is the duty of the propeller to convert the torque of the shaft into a forward thrust that results in the motion of the boat through the water. The force resulting from the torque can be represented by the arrow in Fig. 4. The length of the arrow being proportionate to the force in pounds. The resistance to the turning of the wheel offered by the water is perpendicular to the blade surface as indicated by the second arrow. As the force and resistance are not equal or in the same direction there must be a third force, or resultant, and this third force is the thrust that pushes the boat through the water.

As the force is always applied at right angles to the shaft and the resistance of the water is always perpendicular to the blade surface, it is apparent that the thrust will depend almost entirely on the pitch of the blade —other things being equal. This is shown in Fig. 5.

These three forces, or triangle of forces as they are termed in mechanics, must balance—and right here is where practically all propeller troubles originate. All three are variable quantities, each depending on the other so that any change to one affects all three. The most successful propeller is the one that gives the greatest thrust for a given torque. The resistance offered by the water depends mostly upon two things—the blade area and the pitch.

From Fig. 5 it would appear that the finer the pitch the greater the thrust—but, it must be remembered that a wheel with a small pitch must turn many more revolutions to travel the same distance in one minute than a wheel with coarser pitch. If the wheel is turned too fast the blades do not grip the water, they churn through it, so all the advantages of the fine pitch are lost. This loss of grip on the water is caused by the fact that the flatter the pitch the greater must be the resistance offered by the water, as shown in Fig. 5. Now, water is not a solid, and the amount of resistance it can offer is very limited, therefore, if the blade is pushed against the water too hard, the resistance is overcome and the water flows along the surface and over the edge of the blade.

The resistance that the water can offer against the turning of the blade depends upon the blade area. The larger the blade the more water it acts against. If the little arrows in Fig. 6 represent the maximum resistance the water can offer to the large blade A, it is evident that if the narrower blade, B, is turned with the same force, or torque, the resistance offered by the water will not be sufficient to keep it from churning through the water. In ordinary cases the pressure of the blade against the water must be kept below 10 pounds per square inch.

As a propeller revolves in the water, some of the water is given a rotary motion and the blades churn to a slight extent even in the best of wheels, so that the real slip is always less than the theoretical velocity of the column of water. The real slip is greater with a hull built on full lines than one with finer lines.

The difference between the distance actually traveled by the boat and the theoretical distance obtained by multiplying the pitch by the revolutions the propeller turned in moving the boat that far is called the apparent slip, or as it is commonly termed, the slip. It is ordinarily given in percentage of the theoretical distance.

From experiments made with propellers of different designs in testing basins it has been found that a propeller having a pitch of 45 degrees at the center of effort is the most efficient as far as the propeller is concerned. This corresponds very nearly with a pitch ratio of 3.1 at the center of effort or a pitch ratio of the propeller between 1.4 and 1.5 depending upon the shape of the blades.

So much for the analysis of the conditions under which the propeller operates. The next thing is how the theory works out in practice. In the first place the real slip should be small. Otherwise more power is wasted moving water than is used in moving the boat. This would be the condition were the wheel too small in diameter, and is indicated by a rapidly moving stream of water, or race, in the wake of the boat. Remember, the power available to push the boat ahead is proportionate to the volume of water acted on by the propeller, not the velocity of the race, or real slip. It is also evident that the true pitch propeller is the only one that will not cause some drag.

When it comes to the material from which the wheel should be made there is not much choice. The fact that the blades must be thin eliminates all but the strongest metals, leaving iron, steel, and bronze to choose from. Cast iron is fairly strong but is easily cracked and broken by contact with drift. Steel is stronger, but both iron and steel have one great disadvantage, they rust and thus do not present a smooth surface to the water, causing excessive skin friction. Bronze, especially manganese bronze, seems to be the ideal metal. It is as strong as the ordinary grades of steel, the surface can be given a smooth finish that does not deteriorate from the action of water, either fresh or salt, and should the wheel hit drift wood or other obstructions it will bend but not break.

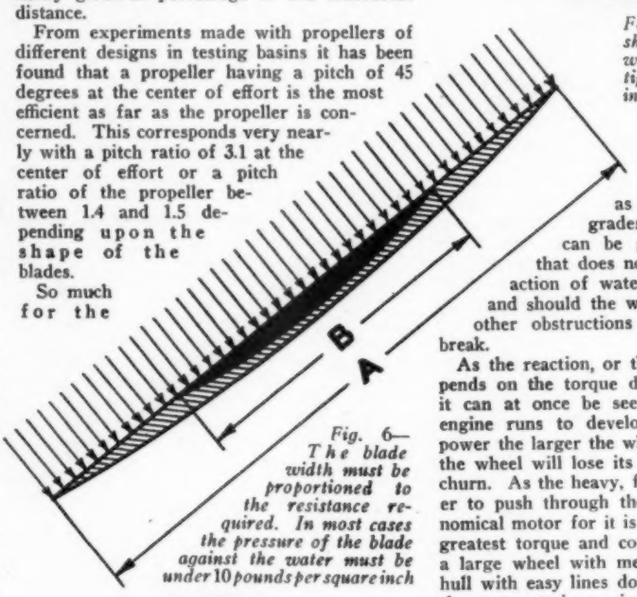
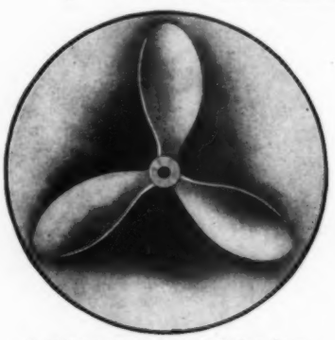
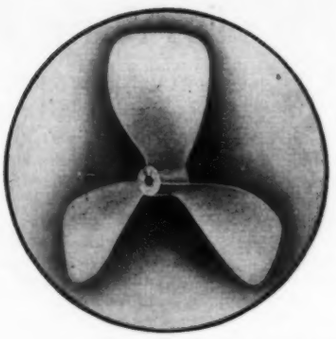


Fig. 6—The blade width must be proportioned to the resistance required. In most cases the pressure of the blade against the water must be under 10 pounds per square inch



At high speeds skin friction is an important factor. A narrow blade is often the best for this purpose.



For towing the blades should have the greatest width and area near the tip, where they will work in undisturbed water

As the reaction, or thrust, of the wheel depends on the torque developed by the motor it can at once be seen that the slower the engine runs to develop a given amount of power the larger the wheel must be, otherwise the wheel will lose its grip on the water and churn. As the heavy, full-bodied hull is harder to push through the water, the most economical motor for it is the one developing the greatest torque and consequently should have a large wheel with medium pitch. The light hull with easy lines does not require as much thrust to attain a given speed so the motor need not develop as much torque. Under these conditions the motor can turn faster and by using a wheel with a little steeper pitch a better boat speed is attained. Fig. 5 illustrates this point.

It has been found in actual practice that a pitch ratio—that is the pitch divided by the diameter—should be about 1 for hulls with full lines and .8 for the tubby boats. Cruisers with moderately full underbody lines and heavy open boats are successfully driven with wheels having a pitch ratio of from 1 to 1.2, while heavy boats having fine lines sometimes show better results with a pitch ratio of 1.3. Runabouts and light boats should have a wheel with a pitch ratio of from 1.2 to 1.5.

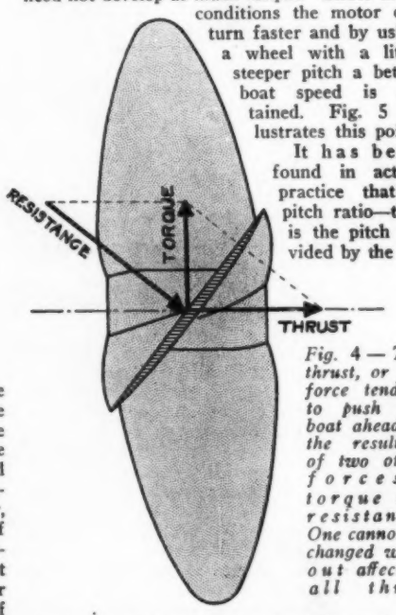


Fig. 4 — The thrust, or the force tending to push the boat ahead is the resultant of two other forces—torque and resistance. One cannot be changed without affecting all three

The width of the blade is dependent on two things, namely, the torque and the speed. There is no question that the wide-bladed wheel is the proper one for the slow turning motor with

(*Continued on page 70*)

Building a 12-Foot Speed Boat

A Simple, Easily Constructed Hull Which with Small Power Will Develop a Good Turn of Speed

By L. B. Robbins

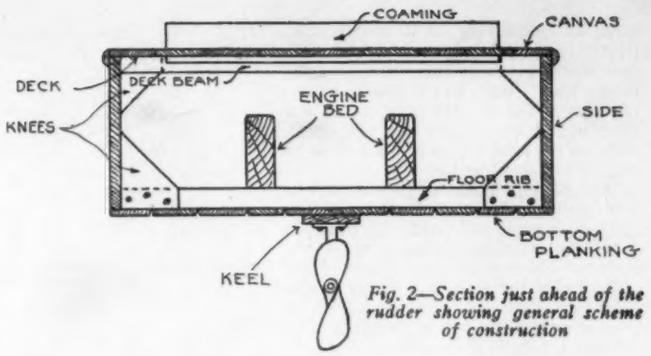


Fig. 2—Section just ahead of the rudder showing general scheme of construction

THE late aviator, Lincoln Beachy, is credited with having claimed that he "could fly a kitchen table" if provided with a suitable power plant. He practically proved his statement when he installed a modern gas engine in Langley's old airplane and flew it as poor Langley never dreamed of doing.

As a parallel, a packing case might be driven over the water at express train speed if fitted with a powerful enough motor. While hardly a packing case, the plans accompanying this article illustrate a miniature hydroplane of the simplest type only 12 feet long and with a motor developing 35 to 40 h.p., capable of maintaining a speed of from 25 to 30 miles an hour, depending upon the speed of the propeller, pitch, size, etc.

The idea is not claimed as original, as a craft has been built along similar lines by an American boat concern, but the aspiring amateur boat-builder can easily build such a craft with but a meager knowledge of carpentering, as there is practically no bending to be done and the finished lumber can be secured at any lumber yard. The small size will allow one to build it entire, in the cellar or the attic, and move it outdoors without tearing half the house down.

The matter of a motor will, of course, have to be left somewhat to the size of the builder's pocket-book and his tastes in engines. A four-cylinder motor will undoubtedly give the best results and create less vibration than one of fewer cylinders.

After you have selected your working space commence with the sides. White pine or cypress is good stock to use. Buy two clear boards slightly more than 13 feet long and a full 18 inches wide. Lay one of them on the floor and measure off six spaces of 2 feet each and one space 1-foot long as shown in Fig. 3. Measure down from one edge, beginning at the left, the following distances on each space line —3 inches, 11 inches, 16 inches, 18 inches, 17 inches, 15½ inches, 14 inches. Drive in a nail at each one of these points and then bend a batten along the outside of these nails the whole length of the board and draw a line on the board along the inside edge of the batten. This gives the curve of the bottom of the boat. Saw out along this line and plane down to its true curve. Saw out the second board, using the first for a pattern. Then saw off the stern ends so they will slant at the angle shown. When finished, the top or deck edge will be 12 feet long and the distance from bow to stern along the bottom 13 feet.

Now lay each side flat on the floor and cut notches in one face and along each edge 3 inches long, 1½ inches wide and ½ inch deep, following the diagram in Fig. 4. This finishes the sides.

Set them on edge in a level spot, curved edges up. Secure them in place with temporary braces so they will be exactly 3 feet 10 inches apart, inside measurement, and so their respective ends come exactly opposite each other. Then place the ribs in the notches, seeing that they fit tight, and secure with 3-inch screws through the sides into the ends of the ribs.

Where indicated in Fig. 4, knee braces made of 1½-inch oak shaped as shown in Fig. 2 should be fastened to the bottom ribs with four 3-inch screws and to the planking with three 2½-inch screws driven from the outside. The top knee braces need only three screws at top and side. The knee braces should be cut from the plank so that the long side of the brace will be parallel to the grain of the wood to avoid any chance of splitting when stressed.

The bow piece should be of oak 3 inches square fastened in the same way.

An oak batten about 1½ x 3 inches in size should be securely fastened with screws to the after end of the sides to secure the transom to as shown in Fig. 3. The stern transom is of oak 4 feet long 19 inches wide and 1-inch thick. Lay it over the ends of the sides and battens and fasten to the battens with 2½-inch screws. The joint between the end of the sides and the transom should be chalked in the same manner as the bottom. This also applies to the seam between the bottom of the side and the outside bottom board. All ribs can be cut out of hard pine or oak and are 3 feet 11 inches long, 1½ inches wide and 3 feet deep.

When all are in place plane off all projecting edges and smooth off with coarse sandpaper. Then turn the frame over and proceed in the same manner with the deck beams with the exception of framing in the cockpit which is explained in Fig. 4.

Before boarding in raise the frame up on two or three horses to a convenient working height and brace firmly. With a chalk line, strike a line down the exact middle of the ribs. Then lay on the two middle bottom boards so their edges will form a seam at this line. Work outward from these two boards, using 2-inch galvanized nails and planed ¾-inch cypress or cedar for stock. Lay as closely as possible, taking care to leave no excessive space in any seam. Countersink nailheads at least ⅛-inch and smooth off the bottom with a block plane, finishing off with sandpaper. The middle side under the keel should be caulked, puttied, and painted before securing the keel plank in place. The keel should then be laid along the bottom directly over the middle seam. Use a 6-inch oak plank 1-inch thick and fasten with as long screws as possible to the ribs. Give a priming coat of white lead and oil, after which let dry thoroughly. Then proceed to lay the deck in the same manner.

To make a water-tight job of the deck it will be well to canvas it. Stretch 8-ounce ducking tightly over the deck boards, using galvanized or copper tacks and lapping the canvas at least 2 inches over all edges. When all secure run a half-round molding around the outer edge of the hull to hide the canvas and trim off the remaining edges with a sharp knife. The inside edges of the cockpit are covered with an oak coaming built of 6-inch boards, ½-inch thick. Have your plumber construct a rudder pipe which can be made water-tight. He can do this by means of an outside and an inside flange at the bottom which draw up tight against the bottom boards and the keel. Fit this in place about a foot from the stern. Then have a rudder made at the blacksmiths something after the pattern in Fig I. The blade is

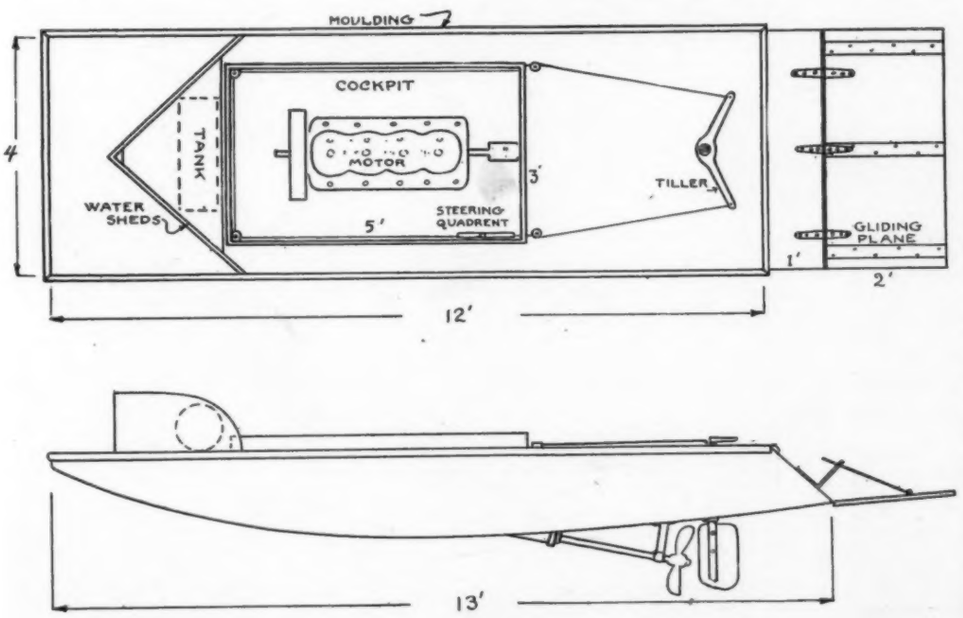


FIG. 1

Deck plan and outboard profile showing general arrangement

about 12 inches long by 10 inches wide, riveted to the post which should be of 1-inch round bar iron, split to receive the rudder blade. Have him also make a tiller like that in Fig. 3. The arms are each a foot long. Have it made so it will key in place on the rudder post to allow it to be shipped and unshipped at will.

The steering quadrant shown in Fig. 3 is easily made of two pieces of oak screwed together and fitted with a handle as shown. Groove the upper edges and pivot the lower end to the inside of the cockpit near the stern and handy to the operator. Run one steering line direct from the tiller through a block and then through a hole in the coaming. Pass the line over one groove of the quadrant to the farther end and nail it in place. The other steering line is run from the opposite arm of the tiller through a block, completely around the inside of the cockpit through the necessary blocks to the remaining groove in the quadrant where it is fastened in the same way. This arrangement takes up all slack in the steering line thus holding the rudder steady at all times which is very essential at high rates of speed.

The two water sheds at the bow can be made of any suitable material at hand. They are intended to prevent spray and water from running down the deck into the cockpit. They also act as a protection for the gasoline tank and can be made more effective by covering with canvas at the top.

The gliding plane at the stern is nothing but a wide board hinged to the lower edge of the transom and held at the proper angle to be most effective. It is 4 feet long by 2 feet wide. In case a board cannot be found wide enough it can easily be made up of several boards cleated together. Attach to the transom by three heavy strap hinges. Have the blacksmith make a pair of heavy angle-irons with three bolt holes in one leg and a ½-inch hole in the end of the other leg. A thumbscrew should enter each of these ½-inch holes. Then a length of ½-inch round iron is fitted into these holes, each leg of which is fastened to the gliding-plane by means of eye-bolts. The arrangement is shown in Fig. 3. The proper angle of the gliding-plane is then adjusted by raising or lowering it and holding at the right point with the thumbscrews. Fasten the brackets to the transom with carriage bolts.

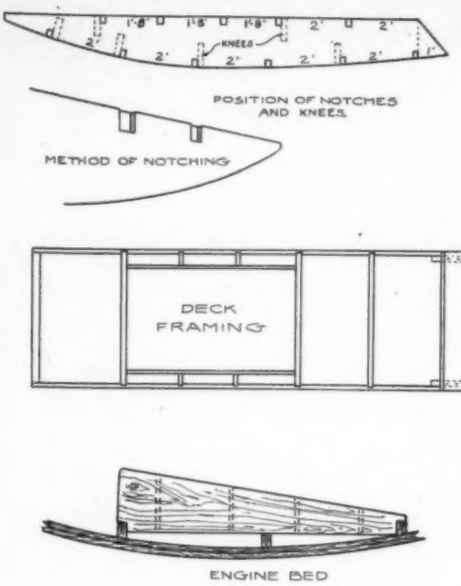
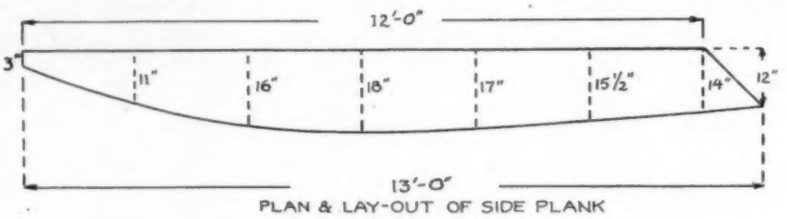


FIG. IV.

Framing details and engine bed timbers



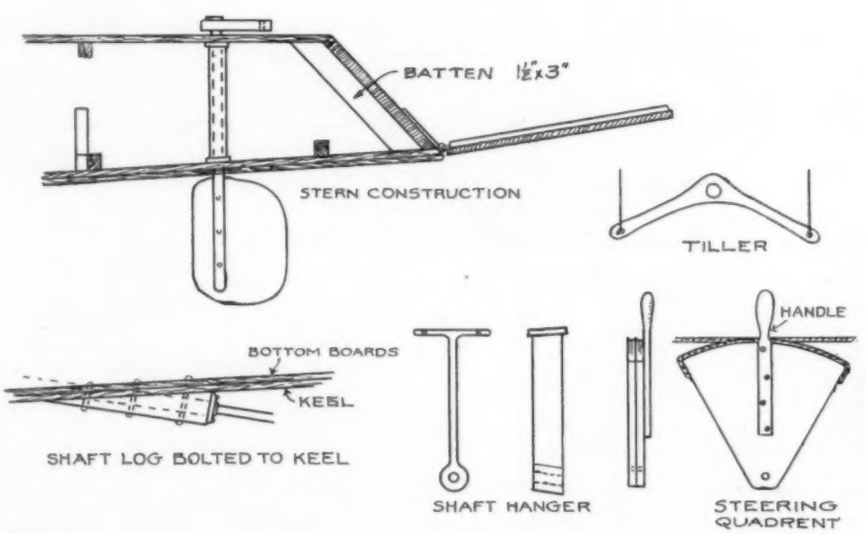


FIG. III

Sketches showing construction of the gliding plane, rudder, strut, shaft log, steering quadrant and other details

This practically completes the hull with the exception of the paint. It might be well to say that white lead should always be used between all joints during every phase of construction. Also paint the interior of the hull before laying the deck. When completed, give the bottom three good coats of marine paint, first caulking the seams with cotton wicking soaked in linseed oil. The deck should also be painted before laying the canvas and the canvas later filled with three or more coats of lead filler and then the desired color.

Varnish the coaming and the molding and your boat will assume a professional appearance.

All metal work, so far as possible, should be of copper, brass or galvanized iron.

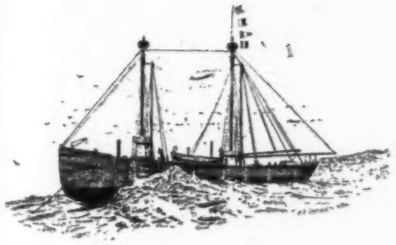
The installing of the motor must be left to the ingenuity of the owner because, as was mentioned before, the make, size, etc., will determine the exact location, and cannot be discussed at great length on these pages. The two diagrams in Figs. 2 and 4 will assist, however, in giving the general idea of the engine bed. Use solid oak throughout and bolt securely through to the ribs.

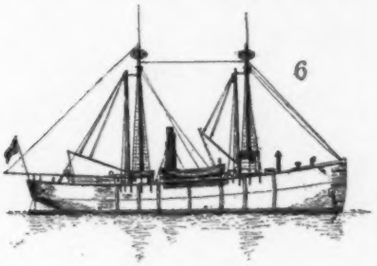
It must be remembered that the longer the engine bed the more securely it can be attached to the hull, and the heavier the engine, the longer the bed should be. The bed shown in Fig. 4 is suitable for a lightweight two-cylinder engine. Do not be afraid to make the bed too long. For the average engine a bed cut from 3-inch oak plank and set on edge would be of sufficient strength. With the motor in place at the required pitch to accommodate the size of the propeller, the shaftlog should then be bolted to the outside of the keel and bored for the shaft.

The shaftlog should be provided with a stuffing box to fit the shaft. All-metal combinations, shaftlogs, and stuffing boxes can be secured from any of the motor boat supply houses which will do away with the difficult job of boring the wooden log, make a tight joint, and have a ball point at the stuffing box to allow the shaft to line up accurately. The hanger in Fig. 3 can also be made at the blacksmiths. This will assist in holding the propeller in line and prevent the shaft from buckling. It is well to have the hole for the shaft in the strut made ½-inch larger in diameter than the shaft and after being assembled fill with babbitt.

Do All Lightships Look Alike to You?

If They Do You Are a Poor Skipper for in Design, Appearance, and Construction They Are Vastly Different. See if You Recognize Any of These.





Can You Pick Up These Lightships?

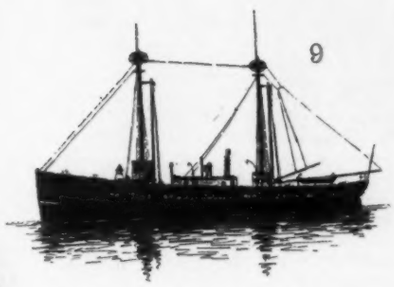
By F. T. Lander

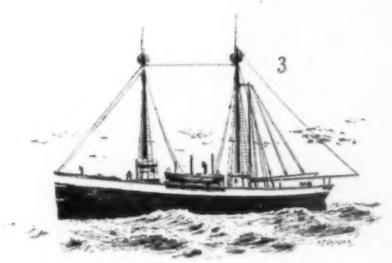
THE sketches shown herewith were prepared from photographs of certain lightships that would be passed in making a cruise between two well-known Atlantic ports. They are correct in detail except that the name which appears on each has been omitted. Possibly you can recognize some of them, or perhaps all. If not, by referring to the Light List of the Atlantic Coast for 1918 their identity may be established, provided you keep a sharp lookout ahead; for each vessel has its characteristics. If a copy of the Light List is not available, write for one to the Department of Commerce, Lighthouse Service, Washington, D. C.; or to the lighthouse inspector of your district; or get one from the customhouse. They may be obtained merely for the asking.

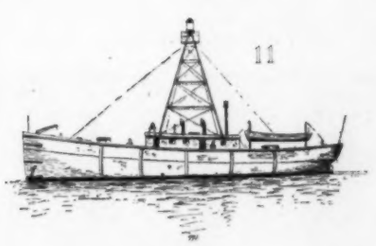
Here's a chance to get something for nothing that is really worth while, for not only will the Light List alone prove a most interesting and instructive source of entertainment, but it will be the means by which a year's free subscription to MOTOR BOATING may be had. All who get eleven correct answers out of the twelve are entitled to this prize, but if you are any kind of a skipper at all you should get the full number; otherwise you are on the wrong course and shipwreck may result.

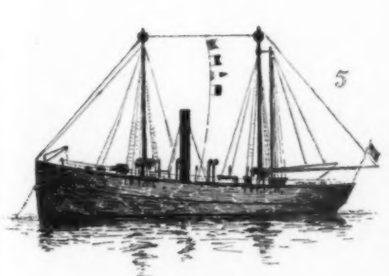
But get the Light List anyway, even though you don't go in for the prize; and while you are about it get a chart of your local waters. If you have not already delved into the rudiments of simple navigation you don't know what you are missing, so why not get all the fun and enjoyment out of the sport instead of only a part?

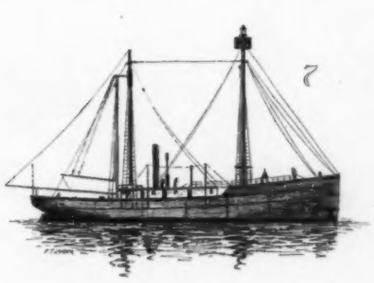
Answers to this puzzle must be in our hands not later than September 1, 1918. Note: Changes in light vessels and other aids to navigation are occasionally brought about by unusual weather conditions. Causes relating to the war may also necessitate changes. The accompanying sketches, therefore, are based on conditions as they were at the time the 1918 issue of the Light List was published.

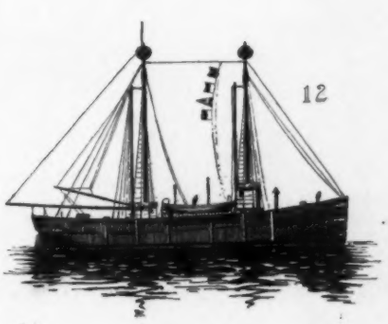












Finback, 136-Foot Auxiliary Ketch

An Unusual Vessel Which, While Large for This Type of Sail Rig, Presents a Pleasing Appearance—Eight-Cylinder Sterling Installed, with Reduction Gear

ONE of the most attractive auxiliaries that has been turned out for a long time is the big auxiliary ketch Finback belonging to C. H. W. Foster, of Boston, Mass., a member of the New York, Boston, Eastern, and other yacht clubs. She was designed and built by A. D. Storey, of Essex, Mass., and measures 136 feet in overall length, 102 feet on the waterline, 25 feet extreme beam, and 13 feet 6 inches extreme draft.

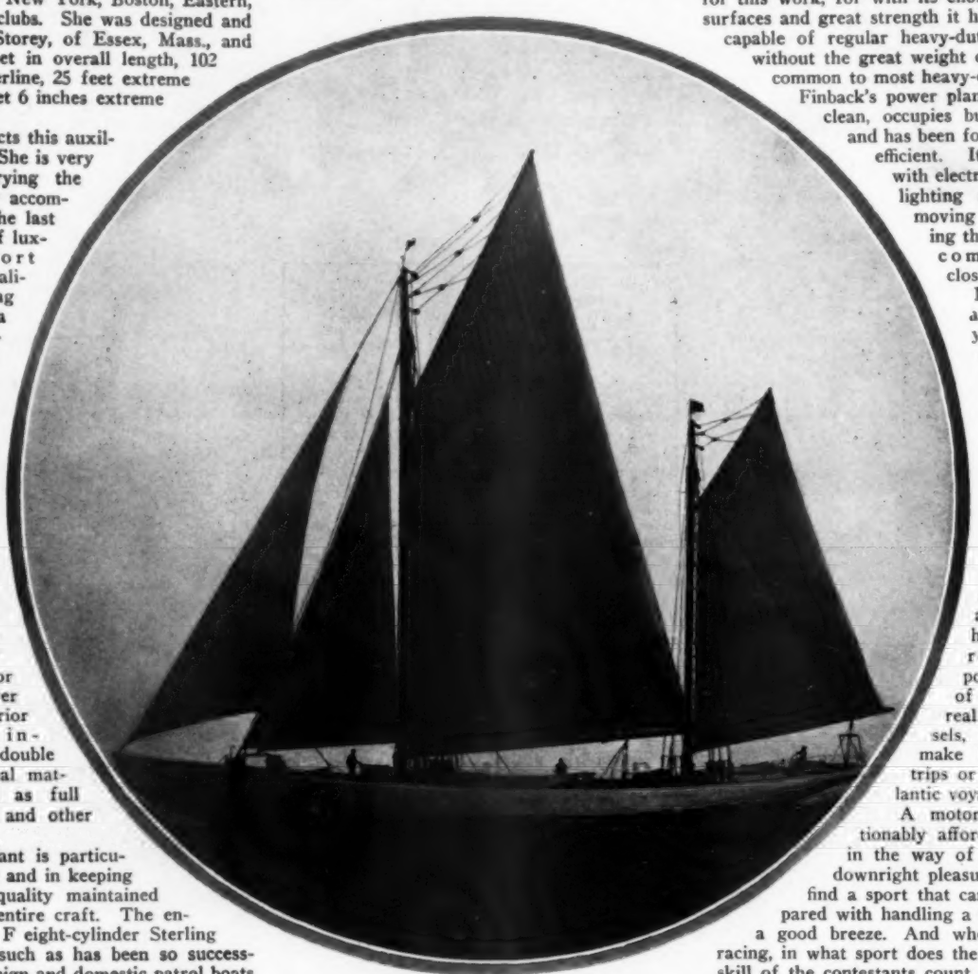
In many respects this auxiliary is unique. She is very long for carrying the ketch rig. Her accommodations are the last word in point of luxury and comfort and she is in reality a great floating palace of a houseboat possessing all the comforts and conveniences of the summer villa ashore, yet at the same time being extremely yachty in appearance, with splendid lines for speed and seaworthiness and unusually fast for her type either when sailing or when under power alone. Her interior accommodations include full width double beds with real mattresses as well as full sized bath tubs and other appurtenances.

Her power plant is particularly noteworthy and in keeping with the high quality maintained throughout the entire craft. The engine is a Model F eight-cylinder Sterling of 150-200 h.p., such as has been so successfully used in foreign and domestic patrol boats and in many fine express cruisers. Finback's engine, however, operates through a reduction gear which is highly satisfactory, the engine turning about 800 r.p.m. and the propeller, a 48x48-inch two-bladed feathering wheel, turning about 400 r.p.m. This use of the Model F Sterling with reduction gear drive has been highly satisfactory for auxiliaries and heavy cruisers requiring a slow turning wheel but a light weight engine of little bulk. The Model F Sterling is declared to be especially desirable for this work, for with its enormous bearing surfaces and great strength it has been found capable of regular heavy-duty service but without the great weight or massiveness common to most heavy-duty machines.

Finback's power plant is quiet and clean, occupies but little room, and has been found thoroughly efficient. It is equipped with electric starting and lighting outfit and all moving parts, including the flywheel, are completely enclosed.

It is such yachts as Finback, yachts that are equipped with adequate auxiliary power, that will help the old time yachtsman, who looks askance at an out-and-out motor boat, enjoy his favorite sport to such an extent that he never before realized was possible. Yachts of this type are real sea-going vessels, well able to make long coastwise trips or even trans-Atlantic voyages.

A motor boat unquestionably affords more thrills in the way of speed, but for downright pleasure it is hard to find a sport that can even be compared with handling a sailing yacht in a good breeze. And when it comes to racing, in what sport does the experience and skill of the contestants count for as much in the final results as the ability of the sailboat yachtsman to take every advantage of wind and wave?



Finback is owned by C. H. W. Foster, of Boston, Mass. She is fast under either sail or power

Photographs by N. L. Stebbins

The out-and-out sailing yacht is becoming more and more a thing of the past, but the sailors are still in evidence

All the room, comfort, and daintiness of a summer villa ashore have been incorporated in Finback's interior

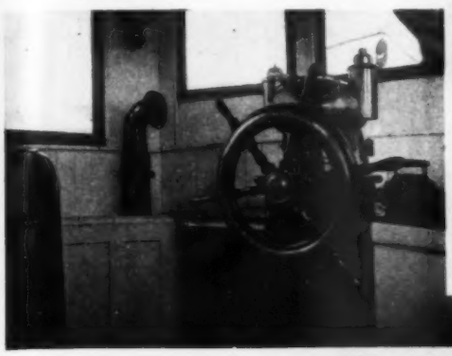
Onward III of New York

A Sea-Going 57-Footer Powered with a 20th Century Motor

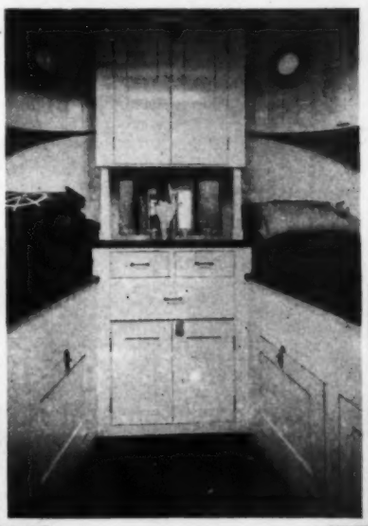
A Heavily Constructed Craft Intended for Offshore Cruising

ONWARD III, shown in the accompanying illustrations is the 57-foot cruising yacht designed and built by the New York Yacht, Launch & Engine Co., of Morris Heights, N. Y., for John A. Still, of Bergen Beach, L. I. She is ketch-rigged, and has a beam of 15 feet 6 inches and a draft of 3 feet 6 inches. Her owner does a great deal of offshore cruising, and, having been the owner of several boats of different types, concluded that the design and equipment of Onward would most nearly represent the ideal for his purposes. The hull is of heavy construction, and in her building every step was taken necessary to give her the utmost in seaworthiness. The power plant is a four-cylinder 6½x8½-inch Twentieth Century motor.

In her layout the fuel tank is placed forward and is followed by a stateroom 6 feet 6 inches long. Following this comes the saloon which is 13 feet in length and is fitted with four berths. On the port side is the toilet, and opposite the companionway leading to the deck. Next aft comes the engine compartment and the pilot house above it, there being communication between the two compartments. Although the sail area is not large, it is sufficient to give the boat a fair speed and in off-shore work adds greatly to the steadiness of the craft. The boat is complete in every way and gives entirely satisfactory service when under sail, or power, or both.



The wheel-house

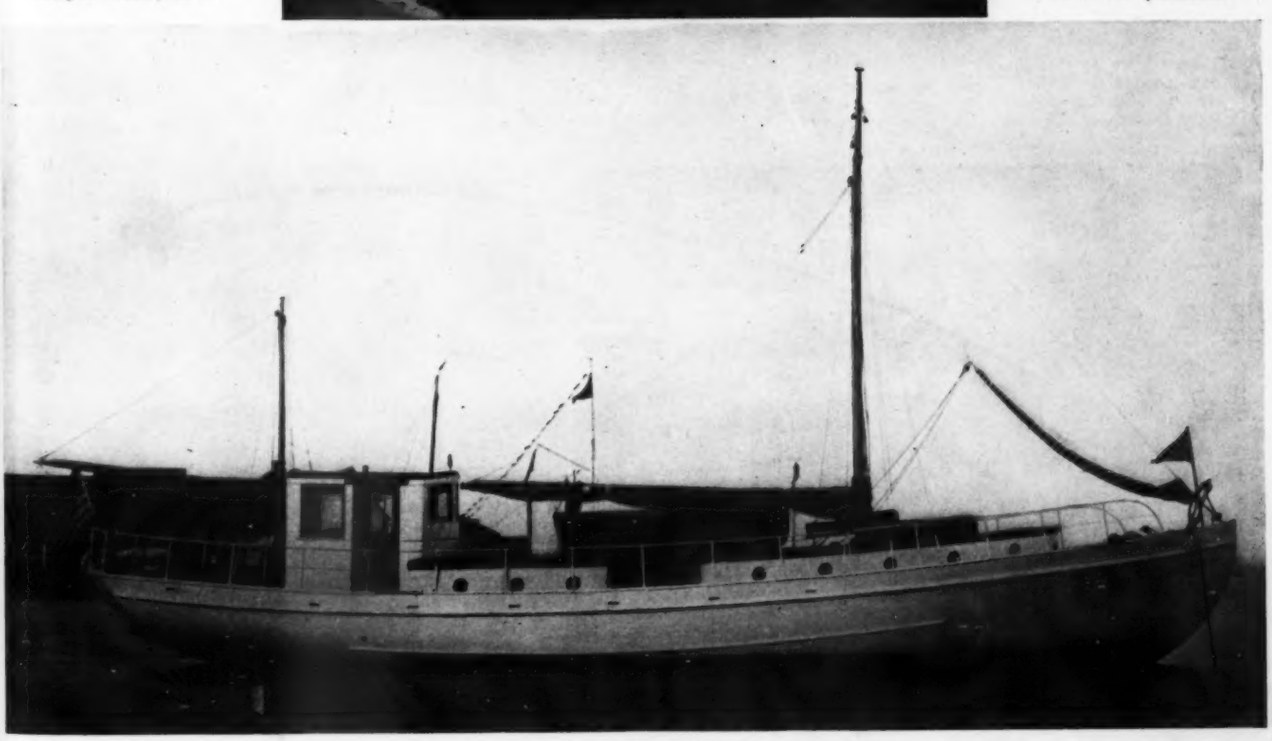


The forward stateroom

The forward deck

Onward III is owned by John A. Still, of Bergen Beach, L. I.

Access to the engine compartment is attained from the pilothouse



Pronto—A Speedway Cruiser

A 55-Footer Having Keel and Framing of Oak and Planking of Cedar Fastened with Copper—Interior of Owner's Quarters Finished in Mahogany—Awning-Covered Deck a Feature

THE Gas Engine & Power Co., and Chas. L. Seabury & Co., of Morris Heights, N. Y., are the designers and builders of the attractive 55-footer shown on this page. The principal dimensions of this boat are: Length over all 55 feet; beam, 8 feet 9 inches; and a draft of 3 feet. On her trial run which was made to Poughkeepsie and return, a distance of about 160 miles, she attained a speed of 22 m.p.h.

Pronto, formerly known as Sonny Bill II, is powered with an eight-cylinder 200 h.p. Model M Speedway motor having bore and stroke dimensions of 5¾x7 inches. With this efficient engine installation it is expected that Pronto will attain a cruising speed of 24 m.p.h.

The after part of the vessel is given over to the owner's quarters which is finished in mahogany and the transom seats are upholstered in the finest of leather. Ample locker space has been provided for. The crew's quarters forward afford comfortable accommodations for four persons.

The hull construction is of the usual cedar planking, copper fastened to oak frames, while the interior and all joiner work is finished in highly polished mahogany.

The engine-room located forward of the crew's quarters houses the Speedway engine and a complete electric lighting and starting outfit. All controls are brought to the bridge deck for one-man operation. An attractive feature of this craft is the spacious cockpit forward which is so arranged as to accommodate ten persons. It is furnished with wicker chairs and built-in seat upholstered. Awnings are provided in case weather conditions are unfavorable.

The side decks are quite wide and permit easy access to the various compartments. The main cabin is finished in mahogany and fitted with a folding table, lockers, and two wide transom seats.

The completely equipped galley, located in the after part of the boat has a three-burner range, and a built-in ice-box. The toilet room adjacent to the saloon is located opposite the galley.

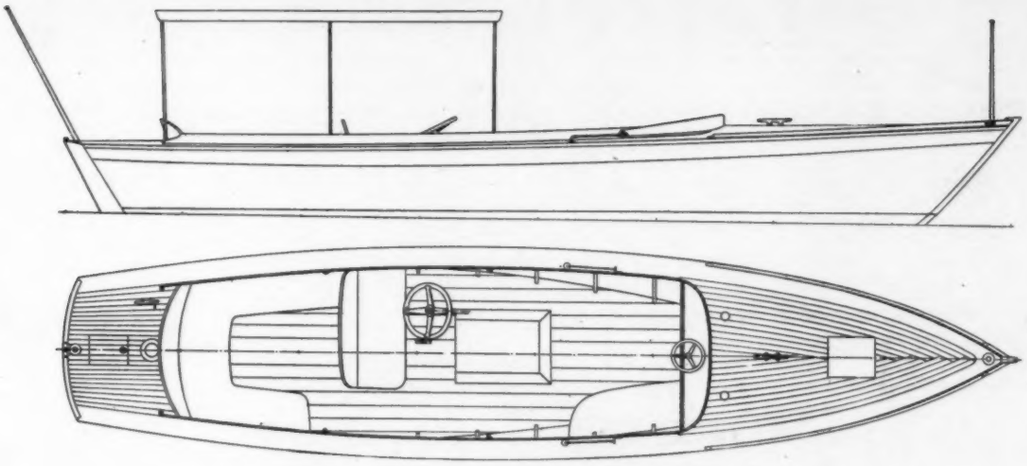
An interesting feature of Pronto is the fact that she can be raised out of the water, lifting bolts being installed fore and aft. It is rather a remarkable installation, as boats of this speed are rarely strong enough to stand such handling.

Photographs by M. Rosenfeld

Pronto was designed and built by the Gas Engine & Power Co. and Chas. L. Seabury & Co., Cons., of Morris Heights, N. Y., for William Thaw

In addition to roomy interior arrangements, Pronto is provided with a spacious bridge deck fitted with wicker chairs and a built-in seat

The eight-cylinder 200 h.p. Speedway motor with which Pronto is equipped. On her trial trip to Poughkeepsie and return she made a speed of 22 m.p.h.



My Ideal Runabout

No. 6—Sandpiper, a 24-Footer

By Thomas Moore

THE original of the design here shown first took the water some fourteen years ago, being a step in the evolution of the writer from a 16-foot flat-bottom catboat such as used by the hand rakers along the shores of Sandy Hook Bay. The waters of this bay are not very well sheltered from the northern winds and the lack of facilities for caring for pleasure boats, in this neighborhood, together with the shoalness of the water at low tide and the terrific wash along the shore caused by the frequent arrival of the Central Railroad of New Jersey steamers, render the keeping of an expensive boat, especially one of light construction, impracticable.

Of course, it is not possible to drive a boat of comparatively heavy construction at the speed of its lighter built sister and the question of working out a design of this sort always necessitates a compromise between general usefulness on one hand and the exhilaration of fast motion on the other. In a locality where there is always possibility of a sea picking up before port is made, the sensation of smashing into it with a slow but able boat is believed to afford exhilaration not to be outdone by that afforded by mere speed.

A glance at the plans will best show the general arrangements adopted. In the original boat the motor was placed about as shown and been changed to almost every practicable location since. Experience has proved, however, that boats of the flat-bottom variety work better with the concentrated weights kept aft, and the motor has since been replaced practically in its original position. The motor is, of course, completely housed in, there being a hinged door in front. The whole top of the motor compartment is also arranged to swing back, exposing all parts of the machine.

My Ideal Runabout

Sandpiper, the sixth of the series, is a flat-bottom 24-footer that was designed to meet the special conditions encountered at Atlantic Highlands and Sandy Hook Bay. The entire bay is very shallow and exposed to northern winds that raise a choppy sea over the sand bars and mud flats, and at low tide boats moored near shore are often high and dry on the flats.

To be a pleasure instead of a worry a boat used in these waters must first of all be seaworthy as the waves sometimes run pretty big. Then, as the boat is often aground, the underbody must be so shaped that there is no danger of it tipping over and being filled by the incoming tide.

The heavy keel and wide, almost flat bottom of Sandpiper enables it to set nearly upright when grounded, while the long overhanging bow and sharp forefoot make the hull easier to drive into a sea than the usual flat-bottom model.

The hull is of light, though strong construction throughout, being of the seam-batten and station-frame type, amply reinforced with knees and floor timbers. The deep, heavy keel and shoe afford ample protection for the propeller and rudder when aground.

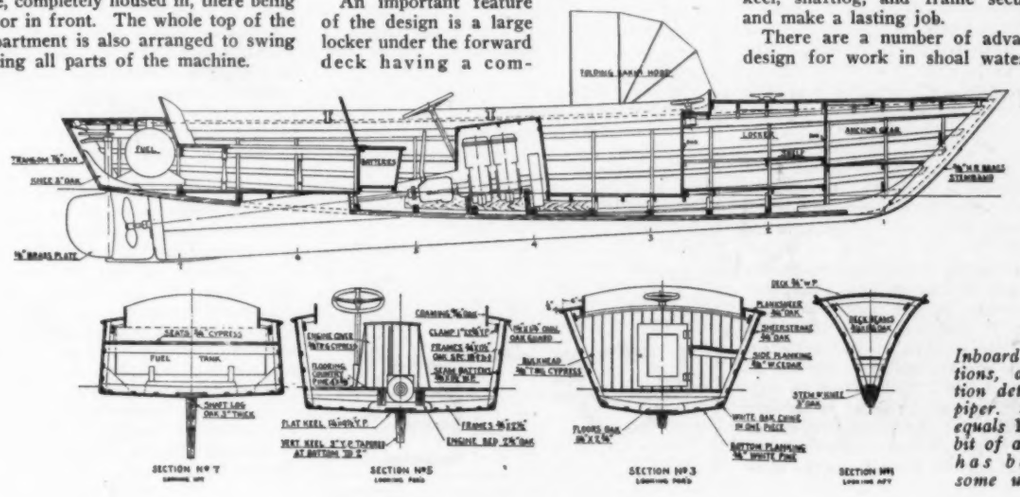
With the motor practically amidships a cockpit at each end is left, the forward cockpit being the smaller. A side seat on the starboard side is shown and a forward steering station. Side seats are an abomination with most people but the arrangement indicated has worked out well in this particular case. This is the best point from which to see bottom and the most enjoyable point to steer from when single-handed in fine weather.

An important feature of the design is a large locker under the forward deck having a commodious shelf at good distance from the floor. The shelf is useful for storing upon it articles liable to be damaged by water and particularly muddy water, articles such as cushions, flags, old clothes, etc. It has been the writer's experience that it is often necessary to leave the boat uncared for, for more or less lengthy periods during which heavy downpours of rain or a windy day on the anchorage often fill the boat with more water than she should be allowed to take on board. The lower part of the locker can accommodate such gear as lamps, anchor, spare rope, etc. Forward of the locker is a space for the mooring line which is often too muddy or wet to be brought into the cockpit. A hatch in the deck gives the necessary access.

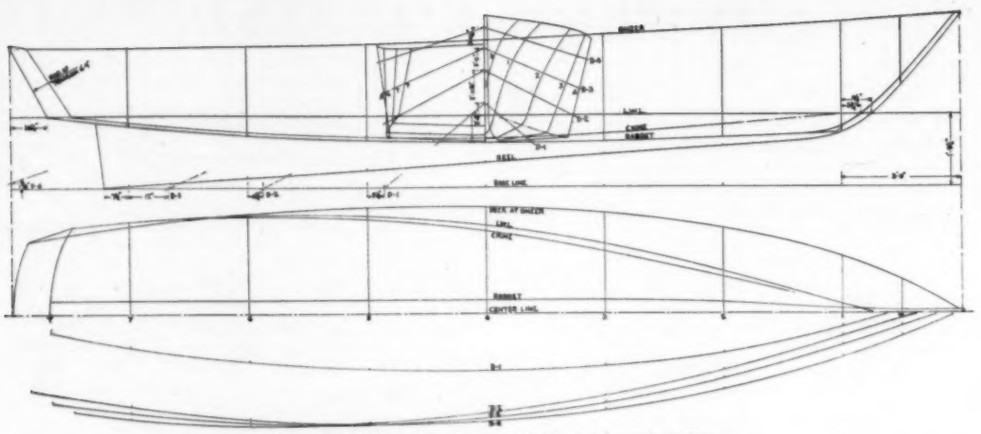
Aft of the engine is a thwartship seat for the main steering station. The seat proper is in box form and contains a water-tight metal case holding the electrical equipment. The main feature of the after cockpit is a commodious thwartship seat in the after end. Side seats are also installed for the purpose of helping out the seating capacity in an emergency. It will be noted that on all the side seats the coaming forms a comfortable support for the back while the thwartship seats are especially well provided for in this respect.

As in the locality described, boats are often aground at low tide, a substantial keel from forefoot to sternpost is provided. The fastening of such a keel presents some difficulties in the way of the propeller shaft. The construction finally adopted called for special long bolts one on each side of the shaft at every frame. These bolts fasten vertical keel, flat keel, shaftlog, and frame securely together and make a lasting job.

There are a number of advantages in the design for work in shoal water. The craft



Inboard profile, sections, and construction details of Sandpiper. Scale ¼ inch equals 1 foot. Every bit of available space has been put to some useful purpose



Lines and body plan at scale of ¼ inch equals 1 foot

generally sets nearly upright when high and dry. This is an advantage when the tide is coming in and the wind rising as water scarcely ever finds its way in over the coaming. With the light draft forward it is often possible, by standing on the forward deck to work into the anchorage with hardly a foot of water covering the sandy flats.

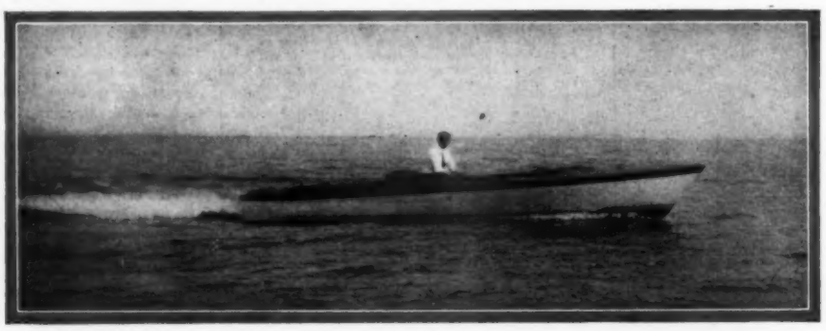
In regard to power and speed, the original boat was fitted with a single-cylinder 7 h.p. motor. This weighed about 500 pounds and gave a speed of perhaps 8½ to 9 miles an hour. A double-cylinder engine of 10 h.p. was next tried, but as this outfit was handicapped by an improperly proportioned propeller and never turned up to its designed revolutions, no appreciable increase in speed was noticed. The present engine is a two-cylinder 6 h.p. machine giving about 8¼ miles an hour. Its small size and compact design makes it a very desirable installation, if speed is not an important consideration. There are at present on the market a number of good machines, both two-cycle and four-cycle, delivering from 10 to 25 h.p. that would make suitable power installations. With the range of power mentioned it would appear reasonable to expect a speed of from 9 to 14 miles per hour.

TABLE OF OFFSETS

STA.	HALF-BREADTHS				HEIGHTS				DIAGONALS				STA.
	DECK	L.WL.	CHINE	RABBET	SHEER	CHINE	RABBET	KEEL	No 1	No 2	No 3	No 4	
0	0-1-0	—	—	0-1-0	4-4-2	—	—	4-3-5	—	—	—	—	0
½	0-10-1	—	—	0-11-0	4-3-1	—	2-8-6	2-6-1	—	0-1-4	0-3-7	0-6-7	½
1	1-5-2	0-7-6	—	0-11-4	4-2-0	—	1-6-0	1-4-1	0-4-1	0-8-6	0-13-4	1-0-2	1
2	2-2-0	1-0-6	0-11-1	0-3-3	3-11-7	1-6-5	1-2-5	1-0-1	0-11-7	1-3-1	1-7-5	1-11-1	2
3	2-6-5	1-9-2	1-6-1	0-4-0	3-10-1	1-3-7	1-1-5	0-11-6	1-3-7	1-10-1	2-2-3	2-5-3	3
4	2-8-4	2-2-1	2-1-1	0-4-0	3-8-5	1-2-6	1-1-4	0-7-4	1-5-2	2-4-1	2-7-6	2-9-4	4
5	2-8-3	2-3-4	2-2-4	0-4-0	3-7-5	1-2-1	1-1-1	0-5-2	1-4-7	2-4-2	2-7-4	2-9-5	5
6	2-6-4	2-6-0	2-5-3	0-4-0	3-6-4	1-1-4	1-1-0	0-3-6	1-3-7	2-2-1	2-5-1	2-8-1	6
7	2-2-6	2-4-5	2-4-3	0-4-0	3-6-3	1-0-3	1-0-7	0-2-4	1-0-6	1-5-0	1-8-1	2-4-1	7
7½	1-10-1	2-2-4	2-2-4	0-4-0	3-6-3	1-0-4	1-0-4	—	0-9-4	1-2-5	1-5-3	1-8-2	7½

FEET - INCHES - EIGHTHS — TO OUTSIDE OF PLANKING

The action of the original model was quite interesting. Instead of the deadrise shown in the design, the bottom was practically flat, and this being the case, the greatest speed was attained with the forefoot just barely immersed. The deadrise forward will undoubtedly reduce the power required for driving a hull of this type, especially at the higher speed-length ratios, and at the same time prevent any tendency toward pounding in rough water. Practically all the water is displaced underneath the hull, there being a very small bow wave. The deadrise given the forward sections will promote this action especially as the bow rises somewhat at speed. The form adopted also gives great initial stability. This is a distinct advantage when carrying passengers unaccustomed to small boats or who are inclined to be timid on the water. It is possible to walk from stem to stern on the six-inch deck provided without being thrown off by the heel of the boat. Considerable floor space is provided and all these features give facility in standing up and walking about.



Sandpiper on Sandy Hook Bay. Although not built for racing, this little runabout shows a good turn of speed

What Is a Ton?

The Meaning of Such Terms as Displacement, Dead-Weight, Gross and Net Tonnage, Etc.

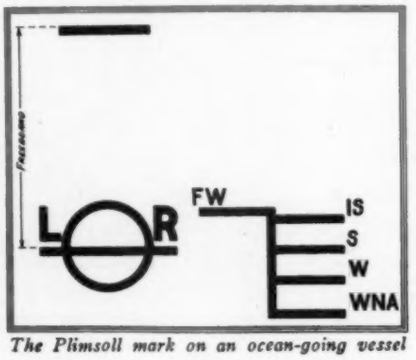
THE demand for ships—and then more ships—columns of news and discussions of the shipbuilding situation that appear in every newspaper, and the awakening of the entire country to the need of a large merchant fleet for war needs and the advantages of such a fleet flying the stars and stripes in the days of peace soon to come has awakened a nation-wide interest in ships and things nautical.

There is not an article in the press but what mentions tonnage, displacement in tons, dead-weight carrying capacity in tons, and gross and net registered tons. Now, what are all these tonnages?

In the first place the *displacement* in tons is the actual weight in tons of 2,240 pounds of the water displaced by the ship, its cargo, passengers, etc. In other words it is the weight of the volume of water that would be required to fill the space occupied by the hull of the vessel were it lifted bodily from its natural element. The *displacement* is exactly equal to the weight of the vessel with all its equipment and cargo, so that the *displacement* and *dead-weight tonnage* are one and the same thing.

The *dead-weight carrying capacity* is the weight in tons of 2,240 pounds of cargo that a ship can carry. It is also the difference in displacement when a vessel is loaded and empty.

The *gross-tonnage* is the cubic contents of the enclosed portions of a ship, but in this case 100 cubic feet of space is termed a ton. The *net tonnage* is the cubic contents of the enclosed portions of a vessel available for carrying capacity and is determined by subtracting from the gross tonnage the cubic contents of such space as is actually necessary for the propelling machinery, supplies, crew's quarters, and the space used exclusively in the work of navigating the ship. *Net tonnage*, the same as *gross tonnage*, is figured in tons of 100 cubic feet.



The Plimsoll mark on an ocean-going vessel

Now, a ton of 100 cubic feet may seem a peculiar quantity, but it was devised as a means of simplifying the measurement rules. It originated in England in 1854. At that time the registered tonnage of the entire British merchant marine was compared with the total cubic contents, and it was found that the ratio of tonnage to contents was about 1 to 98. To simplify calculations and at the same time not make radical changes in the tonnage, a ton of 100 cubic feet was adopted.

This same measure for tonnage was adopted as standard by the United States in 1864, and is now practically universally used. Most charges, such as canal tolls, dockage fees, tow-

(*Continued on page 76*)

THE PRIZE CONTEST

Rules for the Contest

ANSWERS to the questions addressed to the Editor of Motor Boating, 119 West 40th St., New York, must be (a) in our hands on or before July 20, (b) about 500 words long, (c) written on one side of the paper only, (d) accompanied by the senders' names and addresses.

The name will be withheld and initials used.

QUESTIONS for the next contest must reach us on or before the 20th of July. The Editor reserves the right to make such changes and corrections in the accepted answers as he may deem necessary.

The prizes are: For each of the best answers to the questions below, any article or articles sold by an advertiser advertising in the current issue of Motor Boating of which the advertised price does not exceed $25, or a credit of $25 on any article which sells for more than that amount. There are two prizes—one for each question—and a contestant need send in an answer to but one if he does not care to answer both.

For answers which we print that do not win a prize we pay space rates.

For each of the questions selected for use in the next contest, any article or articles sold by an advertiser advertising in this issue of Motor Boating, of which the advertised price does not exceed $5, or a credit of $5 on any article which sells for more than that amount.

All details connected with the ordering of the prizes selected by the winners must be handled by us.

Questions for the October Issue

1. Does it seem reasonable that concrete construction may be used for small motor boats? If so, how would the cost compare with wood construction?

Suggested by L. R. L., Columbus, O.

2. Describe and illustrate how the dangers arising from back-firing through the carburetor can be overcome.

Suggested by G. A. L., Washington, D. C.

Is the Sport of Motor Boating Holding Its Own?

Answers to the First Question in the May Issue

"Is it your belief that there is any falling off of interest in the sport of motor boating? If so what are some of the causes and how do you believe interest may be revived?"

Stock Boats with Complete Equipment Would Help Boost the Sport

(The Prize-Winning Answer)

THE writer believes the answer to the query, "Is it your belief that the sport of motor boating is falling off and if so why?" should be a sort of a conditional one, as some sections of the country may show a big gain and others a reduction.

Personally he thinks that while the sport is in no manner falling off, yet at the same time it does not go ahead at the pace it did during the "fad" time around 1906-8, when long distance club cruises were in vogue.

As a comparison let us look at the present popularity of the motor car as against the motor boat and see why the car seems to be the general choice of the average man. Take the actual use of a car which is generally kept in some nearby garage or more often in a small one in the back yard as against the boat located at least twenty or more minutes away from the house and generally in some place having poor transportation. In order to use the car it is mainly a case of filling her with oil, gas, and water and occasionally a bit of exercise with a tire pump, more often on a hot day in the sun, but in general this can be done under cover and at any old time.

With a boat it is usually a case of getting to the anchorage, removing canvas weather cloths, or hunting up a dinghy if she is anchored out, and after getting aboard oilin' up, tankin' up, getting fresh water, and the little odd jobs one likes to do but which takes time and which means good sport, but rather tiresome, when done every time one goes for a cruise or trip.

Then after underway and some pretty town or spot is located and one wants to go ashore and explore, its a case of looking for a dock or landing where one is not asked a fee for the privilege of mooring an hour or so and at the same time where the boat is not rolled around by the wash of passing craft while a car can hike up any of the roads or streets and lay up most anywhere at any time.

In the matter of cost the car buyer has a fixed price and an idea of what can be expected from the various makes as to service, miles per gallon of gas, tire results, cost of spare parts, and what is more important at the time of purchase he generally knows just what he gets in the way of equipment and is not loaded with a dozen or more articles not included at the time of sale but absolutely indispensable if the rig is to be used. At present a motor boat of the stock class is a rarity and even if a builder were to try to put up a large number of duplicate hulls his purchasers would have individual ideas as to power and equipment and were he to state this is a stock boat and carries such a motor, such equipment, etc., he would be turned down by the average man who seems to think he has a better idea than his neighbor as to boats, and who, in order to prove his ideas would spend a hundred or more dollars at some shop so as to get a "special" outfit.

As to repairs it is usually a case of send to the motor shop for them or get a local shop to handle the job and tack on a good price while car builders early recognized the term service and have established service stations in the better locations which helps their new sales considerably. While a number of marine builders are trying to do this, yet it takes time and a bit of capital, which the average boat owner overlooks when thinking of winter overhauling and he therefore goes to a shop which did not have to tie up with parts and can therefore cut the service station's price a bit, which results in the service letting the parts out and making no attempt to keep a big supply, to the subsequent loss of all concerned.

Now as a remedy of some of these things the writer believes it is first up to the clubs to make a determined effort to promote stock types from the outboard type to the cruiser, offer prizes in the form of equipment or Liberty Bonds for such stock craft and encourage competition between designers and builders by deciding on the general type wanted and far enough in advance so that it would be carefully thought out and not rushed. Then to build large boat-houses or motor boat garages where slips can be rented for a reasonable sum, so the bother of covers is forgotten, to get after various towns and cities for public docks suitable for small craft and in desirable locations, to maintain suitable stations for the sale of oils, gasoline, and such necessities.

And it is up to builders and designers to create such stock craft as their experience teaches, try them out and get a fixed price with a list of all equipment found necessary and not try to add various gingerbread trimmings as absolutely desirable but not included in sales price.

When this is done or underway the sport will show a steady growth unaffected by fads and be of untold value to all.

H. A. G., Buffalo, N. Y.

* * *

The Sport of Motor Boating Is Here to Stay

THE sport of motor boating is just now seeing its popularity affected in two ways. The first of these was inevitable and is caused by the gradual and natural ending of what might be termed its boom period. The second is caused by the war.

In all great out-of-door sports we find two classes of enthusiasts. Those who possess a deep and lasting love for the sport itself and those who are attracted by the lure of a new sensation and who, hearing much talk about a novel recreation, and seeing it prominently featured in newspapers and popular magazines, wish to connect themselves with whatever is considered up-to-date. They are the ones who always follow the crowd.

Every sport has its boom period. Bicycling in a few years achieved a wonderful popularity. Canoeing, lawn tennis, even croquet have passed through a similar period of popular enthusiasm. Automobiling is passing the summit of its boom and now the airplane is bidding for the favor of the out-door masses.

Motor boating from its early years made a particularly strong appeal to the sport-loving element by reason of its novel and attractive features. As improvements in hulls and motors rapidly followed one another and cruising became increasingly popular great numbers of people bought boats and engaged in the new and fascinating pastime. The racing side also attracted much attention. It was, naturally, only to be expected that of thousands who had previously possessed no particular love for the water, many would tire of the sport and abandon it as suddenly as they had adopted it.

The real strength of any sport is shown only after its boom period is passed. Just as thousands of bicycles are in use today, just as

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canoeists are active on every lake and stream throughout the country, so will motor boating assume its permanent place among the world's great sports.

There will be less said about it in the popular magazines—the great reading public may be interested only when a world's speed record is broken or a palatial motor yacht for some millionaire yachtsman is launched. We must not expect to see our favorite pastime continually as many of its former sporting followers have already tired in turn of the automobile and are forsaking the sea and the road for the newer thrill of flying. But motor boating will always enjoy its full share of popularity. It will always be a leader among out-door sports. The men and women who consider it their sport are with it because they love the sea and life upon it under conditions made possible only by the motor boat. For them nothing else will serve.

Just now the World War dominates everything. The younger motor boatmen are with the Army or Navy fighting our country's battles on land or sea or earnestly training in preparation. The yacht and motor boat clubs are sadly depleted in active membership and will of necessity mark time until peace restores normal conditions of work and play. Our home club, for example, now has every flag officer and over forty members with the colors.

And so it follows that motor boating is being somewhat neglected. So are all the sports. Plainly it is up to the older club members to keep their boats in commission and the home fires burning in the club houses, so that after the war is over our favorite sport may lose no time in regaining its vigorous stride.

We should also in this trying time support the publications which have done so much to make motor boating what it is. They must find conditions very difficult with the cost of publication ever soaring and circulations doubtless much curtailed.

Just now there would seem to be no legitimate way to boom the sport. The public, overburdened with so much serious business is in no mood to countenance undue activity in any pastime however deserving.

The policy of the sport is simply to carry on as best we may until with the coming of a happier day our boys will return to us, victorious. Then we can all turn to our favorite pastime with light hearts, and we may be sure that with the coming of peace motor boating will hold and strengthen its position among the greatest of all recreations.

A. O. G., Portland, Me.

* * *

A Need for Co-operation and Education

TO pretend that there has not been a falling off of interest in the sport of motor boating would be to at once blind our eyes to certain incontestable facts, and at the same time to display a lack of patriotism exactly opposite to the real feelings of the thousands of motor boat devotees who are giving their lives, their services, their boats, and their dollars to the one big job which faces America today. All sports, motor boating among them, have suffered, must suffer, should suffer for the time being until America's message has been carried to Berlin across the blood-soaked poppy fields of Flanders and the shell-torn meadows of Picardy, and until the Victory of right and of freedom has been securely attained.

Yet the war is incidentally giving motor boating a boost which if taken advantage of will make the sport greater and even more popular than ever. Thousands of naval recruits are learning for the first time its joys. Yacht and motor boat clubs should be ready to receive them when the war paint gives way again to yacht white. Hulls and engines have advanced in design under stress of war, far faster than they would have in the quiet days of peace. Seaworthiness and cruising possibilities have been demonstrated by the motor scouts and patrols. The motor boat has proved itself a valuable if not an invaluable factor in winning this war.

It is now up to those within the motor boat industry to capitalize these opportunities which the war has brought them and put through a broad campaign of education and of invitation, too, making it easy and pleasant for men to own and operate motor boats. The best way to accomplish this is through a live on-the-job association of engine and boat manufacturers and by co-operative effort among the yacht clubs of the country.

These things are necessary to the industry and to the sport if it is to take a new spurt after the war and not get crowded out in competition with motoring, aviation, and other sports.

There are other factors besides the war which have tended to retard the development of and to lessen the interest in motor boating as a sport. For some of these factors the industry itself is directly responsible; others are the result of outside influences. Of the latter, no single agency has been so powerful in slowing down interest in motor boating as the low-priced automobile. This is due not so much to a feeling that one obtains greater enjoyment from an automobile than from a motor craft (which is not the case with 99 out of 100 persons), but because of the undeniable superiority of the motor car from the standpoint of convenience and utility. Consequently, a vast number of persons, whose financial limitations prohibit the ownership of both, choose the car because of the convenience it brings them, which sometimes amounts to actual necessity.

Motor Boating's
Practical Handbooks

See special offer on page 49

There are many, however, who would own both a car and a boat if they but knew the real joy and healthfulness of motor boating, together with the degree of comfort and safety possible today. This is, again, a matter of education for a co-operative body of interested men to undertake.

Another serious reason for the lessening of interest in motor boating is due to the lack of attractiveness and sometimes the real unpleasantness presented by the present conditions of buying boats and engines as practiced by the builders and dealers. The consumer is almost always led into a hostile and suspicious attitude by their selling methods. Of these, the chief faults lie in unfair discriminations as to price, failure to make good factory defects, failure to keep promises as to delivery, and a general attitude of forgetting the customer once he has bought. To my mind these are the really serious reasons for the present lagging behind of motor boating as a sport,—reasons which if not corrected, will put it out of the running with other sports which are conducted in a more businesslike, sportsmanlike, and progressive manner.

R. B. B., Larchmont, N. Y.

* * *

An Unselfish Sport and an Aid to the Country

YOU ask is motor boating becoming less popular. As far as my experience goes I would emphatically say no. The call of the water is something which is in the heart of almost all red-blooded people, and sooner or later it will make itself felt. They may not realize it, but this love for the water has been coming down through many generations, and there are very few who do not feel it at one time or another if they are given a chance: And motor boating gives them this chance as nothing else can. Each season sees more and more coming into the sport, and as the average of backsliders is fewer than in any other sport with which I am acquainted, there must be more and more popularity in the sport each year.

Then, too, this war has shown the motor boatman that his sport is one of the few which has done anything worth while for his country. In fact, what condition might not England now be in but for the way in which her yachtsmen rallied to her colors, and guarded her from the sneaking submarine? It was the ready response of those who were willing to "do their all" that has given her her lease on the bread of life.

When a man's sport can be shown to be one of the greatest aids to his country in time of stress, does it need much of an argument to show him that it is the right sport for him to pursue? Then, and then only, is he able to give himself to it with free conscience, knowing that he, too, may be able some day to do his part for his country's sake.

Then motor boating is not a selfish sport as are some of the others. More than any other sport it is one of gratification to others as well as to the one who follows it. There is no other form of recreation which gives as much pleasure to as many people, taking into consideration the number of devotees of it, as motor boating. This is true whether the outlay for the sport be large or small, and it generally is the boat of small outlay which gives the most returns to the most people. This helps make motor boating the sport for the man of moderate means, which, after all, is the true test of any form of recreation.

As to being able to offer any advice for the greater popularity of motor boating, or how to keep it from losing its present status, I am not able, for in this part of the country at all events, this year bids fair to be the very best year we have had for a long time.

C. C. G., Portland, Ore.

* * *

The Manufacturers Should Help

IT is my belief that motor boating is falling off, especially in the neighborhood of Boston Harbor and Massachusetts Bay. There are quite a few of my own friends for instance who were former motor boat fanatics and have given up the sport and are now owners of flivvers and automobiles, which they seem to enjoy and get more pleasure out of. And what is the reason? Simply this—inexperience, inferior engines, not knowing what they wanted and when they did salesmen selling them what they did not want. For instance, if a person desired a good substantial cabin cruiser, they turned out something like a tub or a scow, or perhaps sold him a speed boat, with a quartered oak deck and polished brass fittings that it takes a lot of time to shine. Then perhaps a faulty engine that needs to be overhauled after every trip. Some of the boats are built around the gasoline tanks and others around the engines, so that when repairs are to be made the boat will have to be half torn apart. All these little things tend to hurt the sport.

I myself came pretty near giving up the sport, having tried a little of everything. I have now come down to the medium, that is a medium-built boat, a medium-duty engine, and a medium price. As the average man may only have a chance to use his boat Saturday afternoons and Sundays, he wants the most pleasure he can get with the least effort and cost. Then all there is to do is paint up in the spring, put the boat over, put the gear aboard, and fill the gasoline tank once in a while, and there is nothing but pleasure until hauling out time. There are now a few boat builders and engine manufacturers who believe in simplicity and accessibility and, thanks to them, the sport will come back strong, for there is not a man who would not leave his automobile on a hot, dusty day for a nice fresh spin down the bay or on some lake or river, provided all he had to do was throw off the mooring, turn the flywheel and be off. Then again the magazines are doing good work towards stimulating the game.

E. W. N., Boston, Mass.

Feed Your Motor on Clean Gasoline

Answers to the Second Question in the May Issue

"How do you safeguard your gasoline supply from water and other foreign matter?"

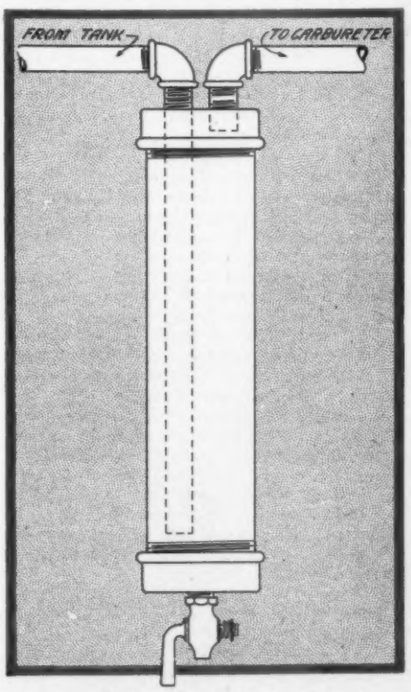
A Gravity Separator

(The Prize-Winning Answer)

ONE of the most annoying things which can happen to an otherwise fine running power plant is water in the gasoline, and before we look at some of the ways in which it can be kept out let us take up the matter of how it gets there. One of the most prevalent ways of getting water in the gasoline tank is the sweating which goes on in any tank, particularly in hot weather, and as this cannot be prevented, it will have to be accepted as one of the things that are. Another is the quality of gasoline from tanks or tank wagons, and here is a little tip. If you are much troubled with water in fresh gas try some other dealer and you will generally find that there is less water in the gasoline from a large tank supply house than from the little fellow in out-of-way places. So carry a good-sized tank and get your gas from some one you know. There are various patent strainers on the market in the way of funnels which will take the water out of the gas to a great extent, but do not try to use chamois skin, as this is not only dangerous but not allowed in most filling stations.

There are also various strainers to be placed in the pipe lines, but look out for the ones with small or, in fact, any kind of mesh gauze in them, as they will clog and stick on small particles of dirt and water which would have gone right through the carbureter. The best method which the writer has seen, is the one illustrated herewith, which is self-explanatory, and has the advantage in that it may be made any size by using different sized pipe. To make this one absolutely sure there can be two pipes, each extending from the tank to the carbureter and going into the carbureter in the form of a "T."

This is a separator which any one handy with tools can make for himself, or which any pipe fitter will make up for a few cents, and is absolutely positive. The cock in the bottom is for drawing off the accumulated water and sediment at intervals. This fitting should preferably be placed close to the tank, although it may be placed anywhere in the boat.



C. C. G.—A simple gravity separator made up of standard pipe fittings

I would suggest that for a four-cylinder engine with cylinders about 4½ x 5 inches that this be made out of one and a half to 2-inch brass pipe, about 8 inches in length and if so installed and used there will be no more trouble with water. Almost all the large commercial boats which burn gasoline out on this coast are using something of this same nature and they work positively in actual use. But be sure and look out for the small strainer, as it is of more harm than use.

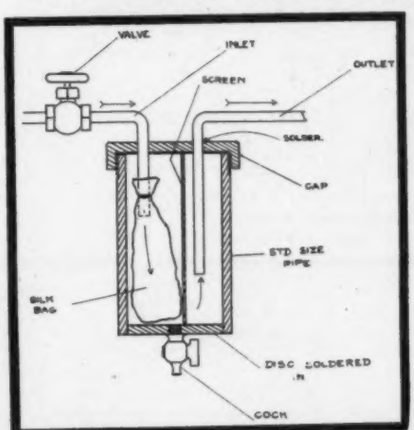
In addition to any strainer it is not a bad plan to drain the carbureter through the little drain cock with which most of them are supplied once in a while, and in this way any small grains of dirt which may have collected will be removed, although with the device above mentioned I have never found any dirt in the carbureter. When double tanks are used separator may be made larger and fitted at the carbureter if desired and both pipes from tanks run into it, although I think separate separators on each tank will work better.

C. C. G., Portland, Ore.

* * *

Keeping the Gasoline Clean

AN installation as shown here will tend to keep down to a minimum the posssibility of getting dirt and water in the gasoline. To start with, use a raised deck plate with a cap, so that water washing the deck cannot run in as easily as with the flush type. Of course when the tank is in a locker this is not necessary. Connect this by a nipple to the tank inlet. When filling always use a funnel that is kept specially for that purpose with a gauze or chamois strainer. Never use a dirty stick to gauge the quantity in the tank.

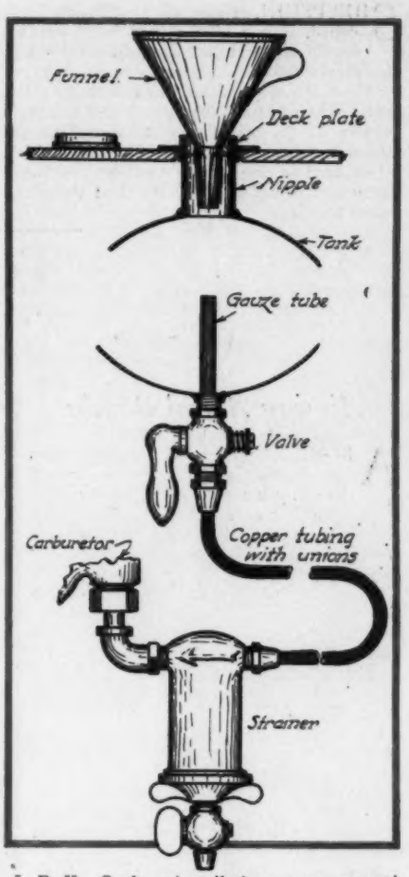


J. F. C.—A silk bag is substituted for the usual wire screen

At the outlet of the tank, use a valve with a gauze tube soldered to the top of it so that the tube will project into the tank. This tube is made of copper, about ⅜-inch in diameter, 3 inches high, and with the top closed. Use gauze of about a sixteenth of an inch mesh, not so fine that a film of water will form on it stopping the flow as the gauze in the funnel strainer. The purpose of this is to keep any large flakes of rust or galvanizing, or shavings, etc., from getting over the outlet and cutting off the flow of gas.

From the valve use copper tubing with unions at each end, so that it can be detached without disturbing the other parts, for blowing out if it ever becomes necessary.

Between the end of this pipe and the carbureter, install one of the gasoline strainers on the market, having a gauze strainer through which the gasoline passes, but the dirt and water are retained, and can be drawn off by a valve at the bottom. A shut-off valve in the gasoline may also be put at this end if desired.



L. R. K.—Such an installation assures a supply of clean gasoline

Water will still get into the tank and carbureter by condensation, but can be drained off by the cocks at the bottom of the strainer and carbureter.

In putting in the piping, do not have any part of it below the strainer level if possible, but keep the slope as near uniform towards the strainer as possible, to avoid any pockets in which sediment might accumulate.

L. R. K., Philadelphia, Pa.

* * *

Uses a Silk Bag

THE sketch shows a device adapted to remove all foreign matter, including water from the gasoline supply and may be installed near the carbureter. The body of the retainer is made from a piece of standard brass piping. A piece of 2-inch pipe about 4 inches long will be right for an engine of about 10 h.p.

The intake pipe projects downward from the cover and on this is tied a little silk bag. By untying the cord it may be readily removed and turned inside out for cleaning. A piece of wire gauze is dropped loosely between the bag and the outlet pipe to prevent the silk from being drawn up against the end of the pipe and in this way retarding the flow.

A piece of packing is inserted between the upper end of the pipe and the cap while a petcock is inserted in the bottom to provide ready

means for priming or other purposes. The device may be readily opened for cleaning, but in ordinary circumstances this operation will not be required more than twice a season.

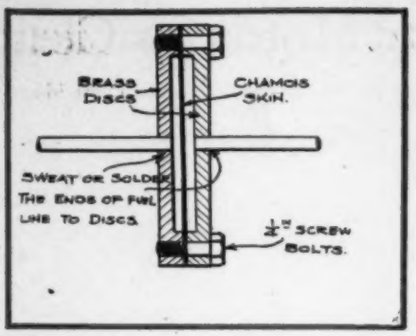
J. F. C., Meriden, Conn.

* * *

An Enclosed Chamois Filter

SHEEPSKIN, or chamois as it is commonly called, is one of the very best materials for filtering gasoline and is generally used in filling funnels.

When the skin is saturated with gasoline, water will not pass through it and the close texture of the material is proof against the passage of dirt, rust, or other foreign particles, which tend to clog up the small orifices in the carbureter or lodge under the float valve and cause flooding.



G. A. L.—A safe method of using chamois skin for filtering gasoline

A permanent filtering attachment in the gasoline feed line, using a disc of chamois skin, is not difficult to make and affords the minimum of trouble and worry concerning the fuel feed when installed.

Two brass disks, a circular piece of chamois skin and four or six ¼-inch brass screws are the materials needed. Make the disks about 3½ inches at the outside diameter and cut out the inside to 2½ inches in diameter. Three-eighths of an inch is wide enough, as the depth of the inside cut need not be more than ⅛ of an inch.

This attachment is a positive assurance against water and dirt getting to the carbureter, is simple to take apart for cleaning, and will repay the time involved in making by eliminating the necessity of frequent clearing out of the gasoline system.

G. A. L., Washington, D. C.

To Help Win the War

Answers to the Third Question in the May Issue

"Describe and illustrate some simple technical or scientific device (not necessarily applicable to motor boats) which might be applied or used in any connection toward winning the war."

Aiming Aerial Bombs

(The Prize-Winning Answer)

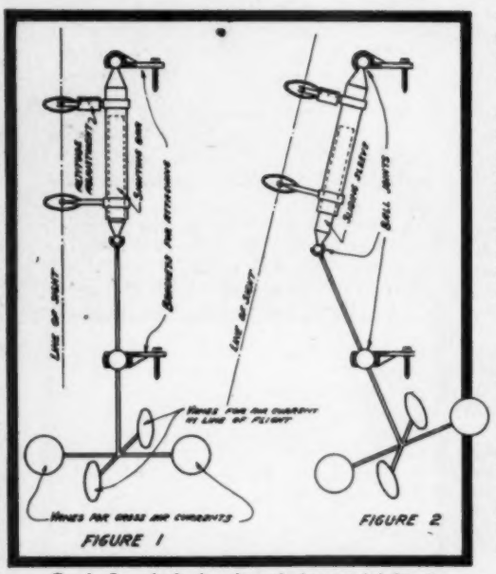
A BOMB dropped with accuracy from an airplane is a feat that we should like to accomplish often in our present conflict. Not that there is likely to be any shortage of these missiles, but a quicker termination of the war would result if every missile found its mark.

Very little information is available as to the devices or methods that the airman uses to direct the bomb to its mark and for that reason I cannot say the following paragraphs will be new to him.

A bomb at the moment it is released from the airplane and until it strikes, is acted on by three forces, gravity, air currents, and its stored energy, which it obtains from the airplane.

In its flight or fall it assumes a parabolic or irregular curved path and its position at any time of its flight may be determined from the three above named forces.

Now as a simple means of involving these factors, that they may be applied at the start of the bombs' journey I suggest the following scheme, as it appears to me, not a finished instrument, but the elements of one that could possibly be brought to a more perfected state.



G. A. L.—A device for aiming aerial bombs from an airplane

First, as shown in the sketch, a sighting bar having an adjustable member on the rear end. This part of the sight to correct for the altitude of the bomb or plane, and might be hand-adjusted for this correction or made automatic by combining an altimeter in the feature.

Second, vanes or deflectors to be actuated by the air currents which are normally parallel to the line of flight of the airplane. The velocity of these air currents are, with respect to the airplane, the speed of the plane and the movement of the air or wind, either in the direction of flight of the plane or opposite to the direction of its flight. Two surfaces at right angles will be desired on the vanes, one to deflect in the line of flight and another to deflect perpendicular to the line of flight or to catch the cross currents of air.

To enable these vane deflectors to be applied to the sighting bar, swivel pointed connections might be used or ball connections could be applied so that the sight line would take a direction opposite to that of the bar to which the vanes are attached.

Whatever type of joint that is used, it should be arranged so that no rotation of the sight bar or the bar to which the vanes are attached could occur.

A sliding rod in one end of the sighting bar, should be provided to allow for the extension between the attached parts of the sight proper, when the vane bar swings back or across.

The size of the vanes will depend upon the weight of the parts and friction in the mechanism, and should be made accurately to obtain the exact force of the air, which will act on the projectile when it is dropped.

The last feature to consider will be that of the centerline of the sighting apparatus itself. If the plane is on an even keel the centerline will be vertical, but as the plane itself may be unable to assume an even keel, then by either one or another method the sight could be brought perpendicular, using a cross test level and having the upper connection easily shifted, or suspending it in a liquid or by a swivel joint somewhat like a compass mounting.

G. A. L., Washington, D. C.

* * *

Win the War By Advertising

HISTORY teaches us that in all controversies, whether between nations or individuals, the laurels most often go to the side most adept in a physiological sense.

From the siege of Troy down to our present day elections we have many instances of the inestimable value of a clever appeal to the emotions.

Our ruthless opponents are constantly seeking to decide the issue by just such means, but their methods are those of savages, or rather brutes, which growl and show their fangs in untiring attempts to put fear in the hearts of all who oppose them. In other words they are capable of playing upon but one of the emotions—fear.

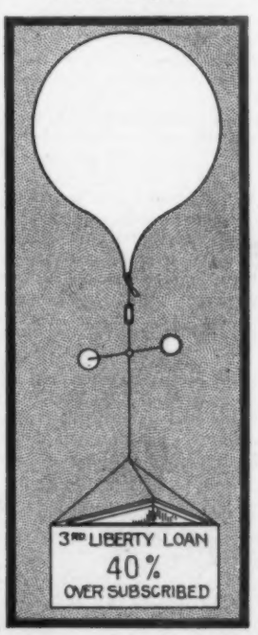
In all their odious propaganda, however, the Huns have advertised prodigiously, if unavailingly, and it is singular that a nation like ourselves which has developed and utilized to so vast an extent the art of advertising should not have utilized it more effectively on the battlefronts to combat the effect of constant deception on the part of German authorities toward their own soldiers.

The condemning to death of our aviators caught dropping pamphlets over their lines is ample proof of the concern which the Germans attach to this form of propaganda.

It would seem feasible to construct large placards arranged as shown in the sketch and attach them to a balloon. The placards could be painted with luminous paint or be constructed as transparencies and illuminated by a lamp. In the latter case the lamp could be fused to light after it has reached a predetermined height and thus avoid attracting hostile fire.

The sketch shows the placards in the form of a triangle while the vanes just above serve to rotate them slowly, bringing a new face around every few seconds. Such outfits could be constructed quite inexpensively.

J. F. C., Meriden, Conn.



J. F. C.—Win the war by advertising

Free Navigation Schools for All

The Boston Power Squadron Is the Latest Unit of the United States Power Squadrons to Offer a Course of Training for the Navy or Merchant Marine

THE country is heeding the call. Our shipyards, many of which have sprung into being almost overnight, teem with activity. The clang of the hammer is heard around our coastline from the State of Maine to the State of Washington.

But ships are but things; they are man's handiwork. Without the quickening of the spirit of man, they are inert—just things. They must be quickened with the spirit of the master-mariner just as they were created at the hands of the master-shipbuilder. Else the toil of the builder is in vain.

"How shall these ships be equipped with qualified mariners," is a question the thoughtful citizen asks. It takes skilled men to operate them. From whence shall these men come? Our Navy has taken many of those who are qualified; the long arm of the draft has reached far among the very cream of our youth. We have ample material—glorious material—but it is for the most part in the raw. What can be done with it?

That is the question that the Boston Power Squadron has set itself to answer so far as it may. This organization is composed of patriotic yachtsmen and others who love the sea, and they have established a Nautical School in which this raw material among our young manhood may be fashioned into a more finished product. In short, it proposes to train men of all ages, from sixteen to forty-five, to become deck-officers.

The Boston Power Squadron is affiliated with the United States Power Squadrons, Incorporated, which has as one of its objects the establishment of a high standard of skill in handling boats. The National organization has twenty-two local units on the Atlantic coast and Great Lakes. It was organized in Boston in 1912, and several hundreds of its members are now in the Naval Service, and nearly all hold commissions from ensign up to the higher ranks. One-third of the members of the Boston Power Squadron hold commissions in the Navy.

Inspired only by patriotic impulses, the National body has been doing excellent educational work by instructing men, both in the Service and out, in the science of Navigation. The Boston Power Squadron last spring participated in this educational work, enabling a number of men, many of whom are now holding commissions, to enter the service of the Naval Reserve.

It is to continue this work along still more effective lines that the Boston Power Squadron has established its Nautical School. It should be clearly understood that its aims and purposes do not in any way conflict with any of the educational work now undertaken by the Government. It is rather to supplement and to make easier the task of the Government to find men fit, mentally, morally, and physically, who are also qualified to undertake the special duties our country demands in this hour of stress.

The Navy Department has established schools in which to place men selected from its enlisted personnel for intensive training and many splendid lads have already obtained commissions through these courses. Necessarily many well qualified for such special training cannot go to these schools as the number selected is small out of the thousands of Navy recruits.

The Shipping Board has organized a system of training of men for the Merchant Marine but their objective is chiefly to provide men for deck and fire room service, not to educate them to become officers. In the work of both the Navy Department and the Shipping Board all the men are regularly enlisted, are paid, and must devote their entire time to the work.

The plan of the Boston Power Squadron, with the hearty approval of the Navy Department, and the Department of Commerce, proposes to give every man the actual knowledge and practical experience whereby he may at once receive consideration to be rated as an officer in the Merchant Marine or find immediate preferment on entering the Navy. Men who have already had some experience on the water, as well as those who have had none, will find much to be learned from these classes. The instruction now offered would in ordinary times cost a large sum. Moreover the opportunities for advancement are now extraordinary. The demand for trained men can hardly be over-estimated.

The classes will be held evenings ashore, and Saturday afternoons and evenings afloat so that a student may receive this instruction without being obliged to give up his regular occupation until he finds he is qualified to enter the service under satisfactory conditions.

Now as to the Nautical School. To recapitulate its objects:

1. To assist the Government in training candidates for service in the Navy and Merchant Marine.
2. To help men advance more rapidly in Government service.
3. To inspire a love of the sea in a greater number of young men.

Classes will be conducted evenings from eight to ten at the well-equipped Boston Yacht Club, City Point Station. Lectures will be delivered and practical instruction given under actual working conditions by competent instructors. It is hoped that Naval Officers when available will deliver lectures on matter pertaining to naval practice. Following are some of the subjects which may properly be designated as the fundamentals which must be mastered:

1. Deck Seamanship.
2. Coastwise Navigation.
3. Signaling.
4. First Aid.
5. Dead Reckoning.
6. Nautical Astronomy.

Upon completion of a satisfactory examination (80% or better) a diploma will be given.

Equipped with the fundamentals, the student is then taken aboard a power boat and given an opportunity to put into practical use the knowledge he has acquired in the class room. From this small boat he is transferred to a larger boat if his capabilities warrant, and given a greater degree of responsibility. Then he must take the examination of the School. If he receives a diploma, he is then entitled to take a specified number of trips on large harbor steamers and tugs, where through the courtesy of the managers and officers of the lines he will be given an opportunity to observe and take active part in the handling of steam craft.

With this practical experience to his credit, the student is qualified to appear before the Local Board of Inspectors for an examination for a license as Pilot or Master of steam vessels. If this examination is successfully passed, he can apply for an officer's position on Bay, Harbor, and Sound steamers. From this the transition is easy. The man of officer-like qualities may aspire to any gift the Merchant Marine Service has to offer, whether coastwise or "deep-sea." If he elects to enter the regular Navy, he is at once eligible to take examination for advanced rating.

All the opportunities offered by the Boston Power Squadron Nautical School are to be had at the small expense of $5, payable on acceptance of application. This will be refunded if within thirty days after receiving his diploma the graduate enters the Navy or

(*Continued on page* 80)

One of the ships for which the Power Squadron schools are training young men

Tuckahoe, the first ship of the new emergency fleet to be launched. This merchantman was launched in twenty-seven days and received her first cargo in thirty-seven days after the keel was laid. A remarkable record, but one that may yet be lowered

First Motor Boat Goes Through the New Barge Canal

By George O. Parker

THROUGH the courtesy of Capt. Charles Scherz, owner of Rose Mary, Motor Boating was given the privilege of having a representative on the first motor boat to make the complete trip from Buffalo to New York, via the completed New York Barge Canal. All hands met as per agreement on May 19 at 10:30 A. M. at the dock, near the Niagara St. bridge, Buffalo. Capt. Scherz, with his engineer, F. Lee, boarded the boat to tune up the engine, while the commissary department, consisting of Dr. Kraemer, E. W. Runyan, and the scribe and cook, George O. Parker, all members of the Tamaqua Yacht Club, of Sheepshead Bay, N. Y., foraged for food.

At 12:30 P. M., all supplies being on board and a short trial run completed, we started on our way for New York. A short run and we arrived at Lockport. Here the magnitude of the Barge Canal begins to grow upon you, passing through two immense locks, each with a drop of 25 feet, without any eddying of currents, just an easy and quiet settling of the water, and at the gates' opening you find you have dropped 50 feet. There is no real need of bow and stern lines as canal rules call for. Here a word of warning to the men at the lines, watch when they cast off, a ¾-inch rope can give some wallop after dropping 25 feet, as the writer can testify to.

At the outset, let me say that if the same treatment is given every motor boat that uses the Barge Canal that was given us, there can never be any complaint. Upon the sounding of the whistle, the lock keeper begins preparations for entering the lock, and upon entering the lock, a man takes bow and stern lines and almost before you come to a complete stop, you find yourself quietly sinking down to a new level. Watch for the currents caused by the spillways, as they tend to swing your boat.

Leaving Lockport you have the longest run of the trip, from Lock 34 to Lock 33 at Rochester. By the map you easily locate each town or city passed near or through.

Arriving at Greece, near Rochester, we were rudely awakened from our enjoyment by being informed that the canal was closed, that there had been a break in the flume, near Pittsford, and no one could tell when it would be opened again. Here we met Mr. Donohough, fleet captain of the Rochester Yacht Club, and judging the rest of the boys by him and the others we met through him, they must be a fine live bunch of motor boatmen. He told us we might get through by taking the old Barge Canal at Greece and Capt. Scherz decided to try it and here we had another wonderful experience. Within the city of Rochester, the old canal is bridged ten or eleven times; all lift bridges, and at not one did we come to a full stop. This was our experience at each bridge. As soon as we sounded our whistle, the warning bell on the bridge would ring, and by the time we would reach it, we would see it begin to lift. Rochester surely gives fine treatment to the motor boatman.

Arriving at Brighton, just below Rochester, we found that we had gained nothing. After a two days' hold-up, we were told that the canal was again open, so entering the old lock, we were shown the vast difference between the old and the new. Here bow and stern lines were needed; passing through one more old lock, we again entered the New Barge Canal above Pittsford. Here we saw what had caused the closing of the canal. We received the impression that the canal was built by completely filling a large valley to make a foundation for cement flume and a small break had happened here, compelling the closing of the gates. Here the novel experience of sailing down an incline which we had noted from the start was very forcibly impressed upon us. Getting near sundown and lights beginning to show, we set our running lights, intending to run as long as possible. But sailing at night is an altogether different problem from daylight. We would find as per chart white light and then red light and then we would miss a light, and after probing around we would find the buoy but the lantern would be missing. We were told afterward at one of the locks that some of the farmers, needing lanterns, took them. We cannot vouch for this, but we found quite a number of buoys without lanterns. Arriving in Newark, we made fast in the terminal and turned in.

Next morning at 5:30, you are quickly dropped through Locks 28 and 27, with the same courteous treatment as at the others. Here, for the first time, you are asked to show your war zone passes. At Baldwinsville we met the ill-fated Anna May. She followed us into the lock. You can stop off at Three Rivers for gas and oil, and for anyone seeking a place for a quiet vacation, this seems a

(*Continued on page 70*)

One of the locks holding millions of gallons of water which will be opened any time, day or night, for the smallest motor boat

The $350,000,000 canal wends its way across New York State like a giant river

Conservation of Life and Labor

Some of the Uses to Which the Gasoline Engine and Electric Motor Have Been Adapted

By Robert H. Moulton

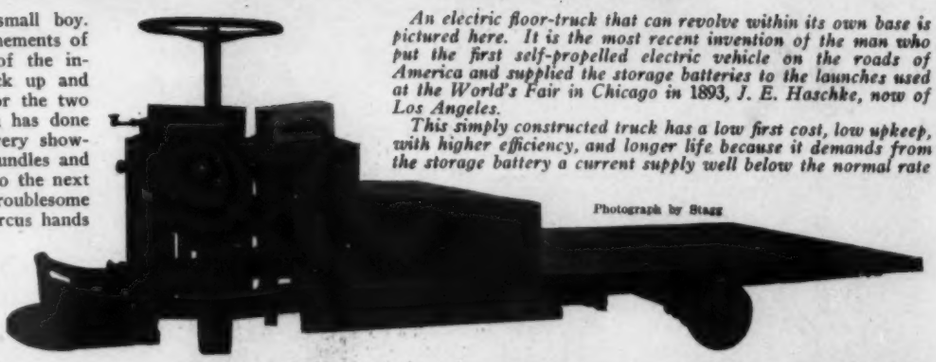
A number of small armored tanks will soon be turned over to the Government for testing out under all conditions. The two-man tank is the invention of C. H. Martin, and is shown fitted with a Ford body, in order that the method of armoring will not be disclosed. Its first appearance in its native town of Springfield, Mass., created considerable curiosity as it was driven beside one of the monster British tanks.

The two-man tank in experimental tests has been able to perform all the feats of the larger machine, and can travel with more speed

HERE'S good news for the small boy. There will be no more postponements of circus performances because of the inability of the show people to pack up and move to the next town in time for the two o'clock matinee. Modern invention has done away with that old bugbear of every showman—folding the huge tents into bundles and loading them on cars preparatory to the next trip. Formerly this was the most troublesome and exacting job with which the circus hands had to contend; rounding up a herd of elephants and placing them securely on freight cars was a mild recreation in comparison. The old way was to fold the huge pieces of canvas into bales, load them on the wagons, and in the morning unroll them again. Now they are wound on huge spools with as much ease and speed as the small boy winds up his kite line, and when ready to set up again they are unwound with equal celerity by the simple expedient of hitching to them a team of horses and saying "Gid-dap." Simple, isn't it?

Of course the spools are quite a bit larger than those mother uses on the sewing machine. As a matter of fact, they are 25 feet long and they are operated by means of a gasoline engine mounted at the back of the truck. Circus tents are made in 50-foot sections, which makes it necessary to fold the piece only once to go on the spools, as against some ten or fifteen foldings by the old hand method. In this way from two to four hours' time is saved, depending upon the size of the circus and the number of tents used. Another advantage of the apparatus is the fact that the spools are provided with wringers, so that on rainy nights the water may be squeezed out of the canvas—and wet canvas is twice as hard to handle in the ordinary way as dry canvas. This also serves to prevent the canvas from rotting, so that the tents last much longer.

In using the revolving tent wagon, which is the invention of W. H. Curtis, of West Baden, Indiana, a section of a tent is fastened to the spool much after the manner of inserting a roll of films in a kodak, the engine started, and the piece quickly wound up. A second section is fastened to the first and likewise wound up, this process being continued until the spool is full. Each spool will hold 7 tons of tents, and for very large circuses several of the spools are required.

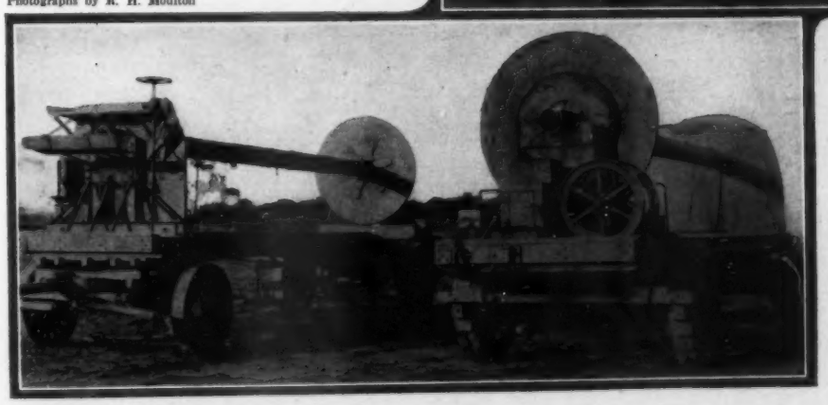


An electric floor-truck that can revolve within its own base is pictured here. It is the most recent invention of the man who put the first self-propelled electric vehicle on the roads of America and supplied the storage batteries to the launches used at the World's Fair in Chicago in 1893, J. E. Haschke, now of Los Angeles.

This simply constructed truck has a low first cost, low upkeep, with higher efficiency, and longer life because it demands from the storage battery a current supply well below the normal rate

Photograph by Stagg

Photographs by R. H. Moulton



Even the circus is adapting the gasoline motor to their work. After the evening performance the huge tents are rolled up on the reels and easily transported to the next town

Cutting the Corners

Some New and Useful Devices That Have Recently Been Perfected

THERE is a new design of folding chair to be had that will not tip forward, owing to its particular construction. Unlike the general run of folding chairs it folds as flatly as a board, and its back at the lower end, is placed to the rear, giving more comfort to the user. While it folds in a manner similar to most outing chairs, it is claimed that it is impossible to unfold accidentally when being carried in a folded position. It is made of hard maple, and is declared to be rigid and solid on the floor. The fact that the government is using many of them should recommend is as thoroughly reliable. K. H. H., Chicago, Ill.

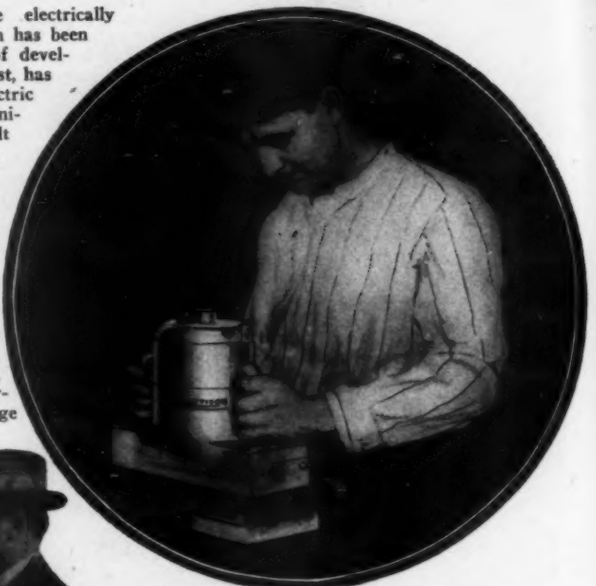
HERE is a silent traffic officer that does duty both night and day and that is always on the job, as they say. It is the illuminated corner dot that has just been invented by a western man and that has been adopted by the officials of Los Angeles, Cal. While it does its work as well as the ordinary corner dot during the day, this feature is believed to be the most effective corner marker thus far presented for night use. It is shaped like the metal hats that are being worn by the boys in the trenches, and is fastened to the street by means of long spikes.

Directly beneath the center of this feature a small section of the street has been cut away, thus forming the battery room. The batteries are passed to the battery compartment through a round opening in the top of the marker. Although the lamp used to illuminate this feature is of small candlepower it does its work effectively.

An important feature about this marker is that it indicates the names of the streets, at the intersection of which it is located. These names appear in white upon a background of red. The name openings are about 3 inches wide and 6 inches long, while the diameter of the marker is about 16 inches. The letters of the street names are about 2 inches in height and may be easily read by day and by night from the machine.

A. M., Tropico, Cal.

THIS interesting little electrically operated machine which has been going through stages of development for several years past, has now arrived. It is an electric rubber for finishing fine furniture, provided with two felt blocks for rubbing which can be easily exchanged for sanding blocks if occasion demands. Current consumption is less than the ordinary electric iron. There is a regulator which provide a varying speed, for green varnish will not stand the speed that thoroughly dry varnish will. Its weight is about 35 pounds, which is said to be the correct pressure for the average rubbing work. K. H. H., Chicago, Ill.

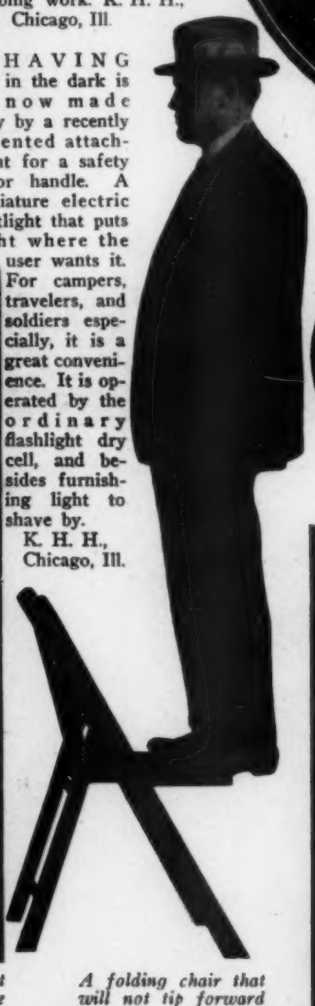


An electrical device which, it is claimed, will replace the tedious hand-work in polishing furniture

SHAVING in the dark is now made easy by a recently patented attachment for a safety razor handle. A miniature electric spotlight that puts light where the user wants it. For campers, travelers, and soldiers especially, it is a great convenience. It is operated by the ordinary flashlight dry cell, and besides furnishing light to shave by.

K. H. H., Chicago, Ill.

One of the latest aids to shaving is an electric light that can be readily attached to the razor handle



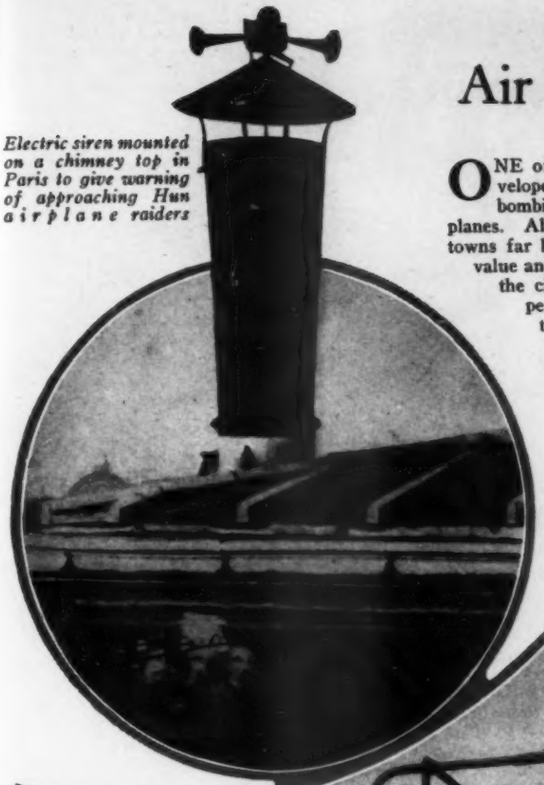
A folding chair that will not tip forward

An improvement has been made in the usual corner dot, combining an illuminated street sign with the traffic marker

ELECTRICAL workers experience difficulty in boring holes through joists or studding high above their heads. With a boring machine of the design shown a workman standing on the floor can put a hole through the ceiling or other location beyond his reach. The machine has a special adjustment for work below the floor for starting the boring. The extension rod for overhead work telescopes into an iron tube. K. H. H., Chicago, Ill.

Electricians need no longer work in cramped and awkward positions when boring holes in the beams of frame buildings

Air Raids Do Not Worry Paris



Electric siren mounted on a chimney top in Paris to give warning of approaching Hun airplane raiders

ONE of the new methods of warfare developed in the present conflict is the bombing of towns and cities by airplanes. Although these raids on unfortified towns far behind the lines are of no military value and only serve to rouse the hatred of the civil population, the Huns still persist in forcing this variety of kultur on the Allies. It has been stated that, during the early stages of the war, every Zeppelin raid on the English Coast resulted in 10,000 men enlisting in the army. Not exactly the result desired by the enemy.

The raids on Paris have been so frequent that a complete system of warning the populace has been worked out and put into successful operation. Sirens operated by either electricity or compressed air have been placed on high buildings, tall chimneys, and other high structures. On the approach of enemy airplanes the sirens are sounded to warn the people.

© Photographs by Kadel and Herbert

Type of compressed air-operated sirens that are mounted atop the high buildings in Paris

© Photograph by Brown and Dawson

THE methods of plowing the sugar cane fields of Porto Rico are widely different from those employed on the farms of New England, where the farmer with his team plods slowly up and down the field behind his plow, turning over one furrow at a time until his task is finished.

One of the successful methods of plowing these large tracts is to use a gang plow having four or more plowshares at each end. This plow is drawn back and forth across the field by steel cables, the power being furnished by a steam traction engine at each side of the field.

The cables are so attached to the plow that the pull raises the leading end and forces the plowshares on the trailing end into the soil. The machine is guided on its course across the field by a plowman riding on the rear end.

In operation each trip of the plow across the field turns over four furrows, the traction engines moving ahead at the end of each trip.

The owners of the sugar plantations of Porto Rico were quick to realize the advantages of using agricultural machinery on a large scale. Plowing is done almost entirely by power

Aids to Industry

Working to music the latest scheme to speed up and increase production

A DRY cleaning establishment in Cincinnati, employing some 300 persons, has come to the conclusion that if these people hear music at frequent intervals while at work it will not only make them happier, more contented workers, but that they will do more work than if they were without the music.

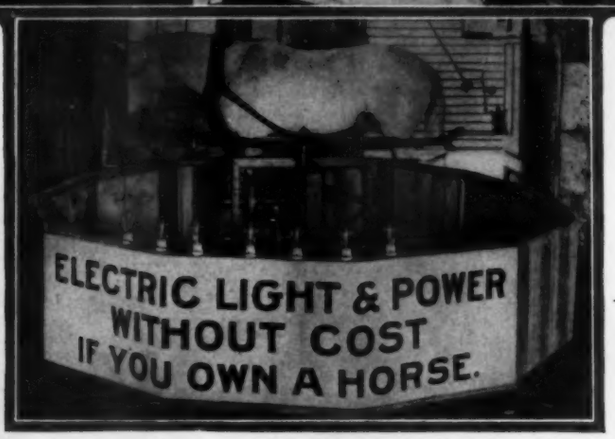
So, following this theory, the enterprising firm has installed throughout the big establishment enough phonographs to keep lively music playing almost all day long. It is like one big entertainment.

This new use of the phonograph is a pleasant way of saying speed up. The lively music does it. There are no lagging moments, and no one gets drowsy over the work. There are many lively dance records and popular songs. The workers hum and sing and the speed of the music puts the speed into their work.

The manager of the firm says that music-while-they-work is an idea that prevails in South American factories. Nearly every South American establishment has its musicians to play for its employees during business hours. The phonograph is the Yankee version of the idea and it has been found to work as well in North America as the factory musician in South America.

The phonograph has been found capable of solving better than any shop foreman or superintendent the problem of promoting voluntary speeding up among employees.

The cigar manufacturers of Cuba and Florida employ a man who reads the newspapers and magazines to the workers, but this does not increase the output. A few lively tunes played on a phonograph several times a day might made the cigars roll a little more lively.



"IF," said McCreery, "a horse can give power to a wagon, why can't he give energy to a dynamo?" So he invented a harness attached to a set of gears, which in turn are attached to a dynamo; the horse steps into the harness and starts to walk around and around on a 14-foot track at the rate of 1½ miles an hour, making electricity all the while.

If the horse should stop, an electrically controlled bell rings, as much as to say, "Giddap Dobbin," and an electrically controlled whip taps him lightly on the back. The electricity goes into a storage battery and, by working three hours during two days of each week, Dobbin keeps it charged.

Photograph by International Film Service

Speeding up Red Cross work with a stretching wheel

Men from the Great Lakes Naval Training Station learning airplane construction at a Chicago aviation school. This training includes the repair of old planes as well as the construction of new ones

WORK in preparation of surgical dressings which formerly occupied six women 55 minutes can now be accomplished by two women in 10 minutes, thanks to the stretching wheel installed at the Red Cross headquarters in Cincinnati several days ago.

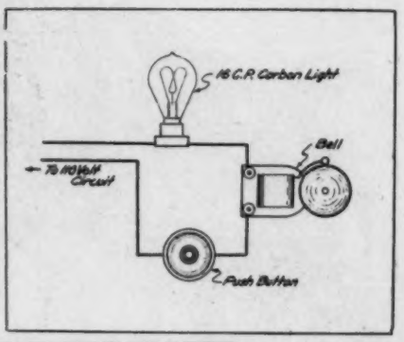
Milton Griffith, of Cincinnati, invented the apparatus. It is a huge wheel 8 yards in circumference, on which eight bolts of gauze for surgical dressings can be spread at one time. As far as is known, Cincinnati is the only city provided with this time-saving device, whereby twenty-eight bolts of gauze can be handled in one day. With the aid of the wheel 100 yards of gauze can be stretched in 10 minutes by only two women. Red Cross headquarters in other cities are requested to take notice of this wheel.

Humanity's Helper—Electricity

Some of the Ways in Which the Invisible Force Can Be Utilized in Commerce and About the Home

A TIME-SAVING improvement, which can be made to any soldering iron, and which will also prove quite convenient, is shown in the accompanying sketch. It is very useful for rapidly soldering twisted wire joints. In this manner splices of the open-end variety may be made with better results than by the use of the tip of the iron for soldering.

A hole 3/16 inch in diameter and 5/8 inch deep is drilled in the side of the iron and filled with solder. The iron is then heated until the solder melts in the hole, and the splice is dipped into it.



Put the door bell on the lighting circuit

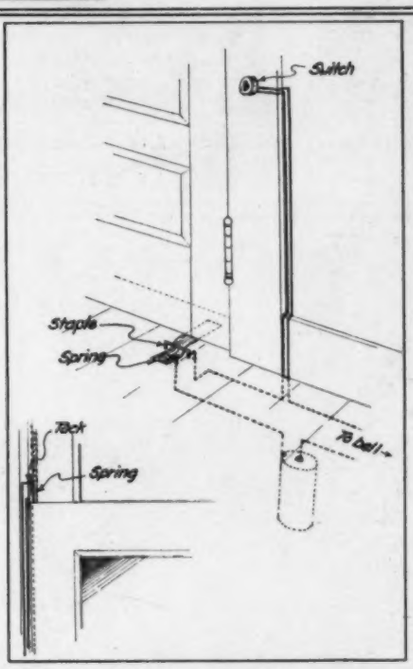
An improved soldering iron for soldering wires or other small objects

THIS alarm is so simple that when once installed there is nothing to keep in adjustment, or to fix, save renewing the batteries when needed.

The alarm switch for a door is made from a piece of clock spring and a staple. The spring is screwed in the floor and bent so that it will press on the bottom of the door when shut and make contact with the top of the staple when the door is opened. One wire runs from the staple through the wall switch to a bell and the other from the spring through a battery to the bell.

When the door is opened the spring and staple make a contact which rings the bell. The wall switch breaks the circuit so that the door may be opened during the day without the alarm ringing.

The screen alarm switch differs from the door switch slightly. A tack is driven in the casing instead of a staple.



A simple home-made burglar alarm

USE this system for operating your door bell; throw your batteries away and have no more trouble.

Lead two wires off from the house lighting circuit, run one direct to the push button, from there to the bell, the other wire through a 16 c.p. carbon light to the bell. The light reduces the power so that the bell coils will not burn out.

The easiest way to connect up this system is to take the wire which comes direct from the lighting circuit and the one that leads through the light, and connect them to the two free wires where the battery was connected in the door bell system.

With this system installed there will be no more trouble with the door bell—in other words, no more batteries to buy.

TOWED by power boats, a long wire drag is employed by the U. S. Coast and Geodetic Survey in order to locate hidden dangers, such as shoals or isolated rocks. Though the method of dragging for such obstructions has been used for a long time, the apparatus has undergone much improvement of late and is now far more efficient than in the past.

The general description of the device is a wire which may have a length up to 12,000 feet, which is held horizontally at a given depth in the water, being supported by a series of buoys. Two or three large launches tow it over the area to be surveyed and if it is not impeded by rocks or shoals it is a matter of certainty that none exists there at that depth.

The bottom wire is kept horizontal by upright wires attached at intervals supported by buoys and balanced by sinkers. Cedar floats in the spaces between the buoys hold it at an even depth. The tow boats are attached at the ends, and in the case of a very long drag a third is attached at the center.

The launches commonly employed are driven by 40 h.p. motors, smaller vessels being considered inefficient for this purpose. They cover a large area in a short time, the 3,000-foot drag, which is the length commonly used, being towed at a speed of from 1 to 1½ m.p.h. The area covered in a day varies greatly, according to the conditions in each locality. When an obstruction is encountered, the wire drag is released and a second party of surveyors proceeds to ascertain the extent of the obstruction and the depth of water above it, while the dragging outfit continues its work.

At the end of operations for a day, the drag is taken out of the water. This requires less than half an hour's time for a wire drag of 5,000 feet length, and about the same time is needed to reset it for work the following day.

The wire drag in use fouled on a pinnacle rock

AN effective method of salvaging metal cargoes sunken in large rivers or harbors, is by use of the Cutler-Hammer magnet, which is constructed to operate under water without letting moisture into its mechanism. The huge magnet is let down into the water and the electricity turned on. When the magnet is raised it brings with it a load of the iron weighing several thousand pounds.

The magnet itself is 3½ feet in diameter and weighs 3,000 pounds. After the magnet is fully assembled a process for making it entirely water- or moisture-proof is gone through. It is subjected to a baking process until all moisture is gone from the interior of the magnet. Air is next exhausted from the magnet casing by a vacuum process and into this airless interior a hot liquid filler is forced which permeates every crevice and hardens into an elastic air-tight seal which has moisture repelling as well as insulating qualities.

Progress in Art and Science

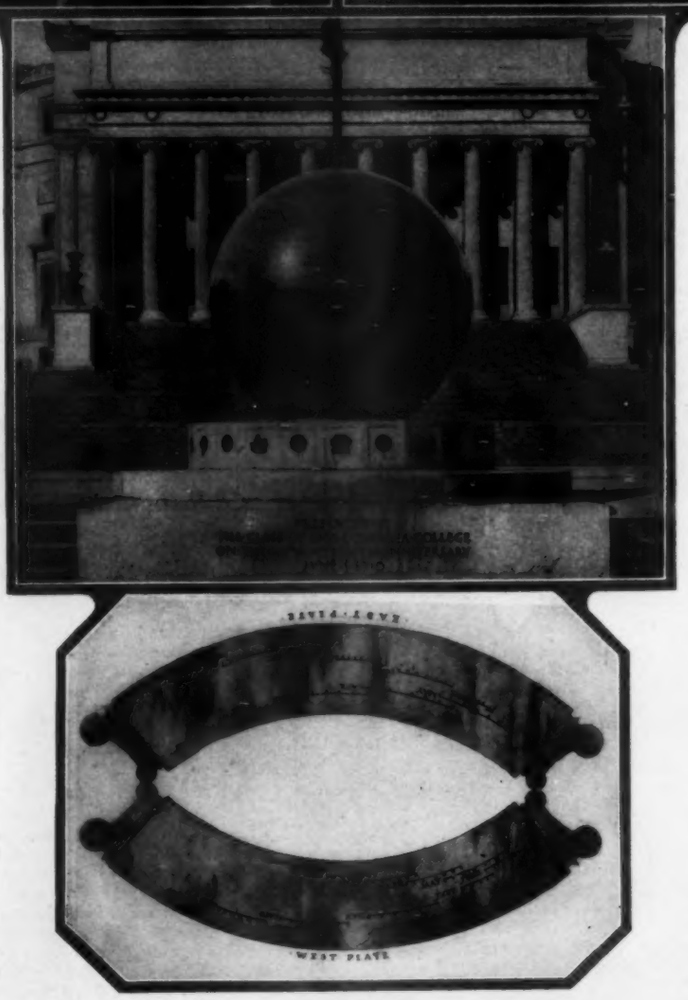
Modern Machines and Methods Applied to Ancient Art

This wood carving machine will carve four pieces at one time. The operator slowly moves a guide tool over the surface of the model while four cutting tools controlled by the guide work the same design out of the wooden blocks

To produce wood carvings by hand is a task requiring the skill of an artist, combined with great patience. Every line and curve must be carefully worked from the rough block with a mallet and chisel, without splitting the work

A HUGE granite ball, weighing 15 tons, which stands on the campus of Columbia University, N. Y., forms the most unique sun dial in the world. The ball casts a great oval shadow on the base supporting it, and it is from the moving edges of this shadow that the time is ascertained. There are really two shadow edges, and for this reason two bronze time plates, an east and west plate, are necessary; one for each shadow.

Sun dials, which in olden days were really used to ascertain the time, indicated solar time; modern watches and clocks show standard time. The two kinds of time vary irregularly throughout the year, the difference in New York City, for instance, being sometimes as great as twenty minutes. In order, therefore, that the Columbia dial should be a really accurate time keeper, it was necessary to make it keep both standard and solar time. As this renders the dial a somewhat complicated affair, it was constructed to indicate time only once each day, at the moment of noon, New York standard time.



A polished granite ball weighing 15 tons forms the gnomon for this unique sun dial

The method of using the dial is shown by the diagrams of the East and West plates. Each of these dial plates has twelve concentric arcs engraved upon it, one for each month. Upon these circular arcs various dates in the several months are marked by small holes. To use the dial at any date, as, for instance, July 4, it is merely necessary to wait until the shadow edge cuts the hole marked 4 on the July circular arc. It will then be noon by standard time.

As it would have cumbered the plates with too many numbers to engrave on them all dates of the year, some of the intermediate dates of each month have been omitted. To use the dial on these dates, it is only necessary to interpolate between the two nearest dates engraved on the East and West plates and locate the point on the same circular arc. This should be done on both the East and West plates to obtain the best results.

Science of the Month

By Hereward Carrington

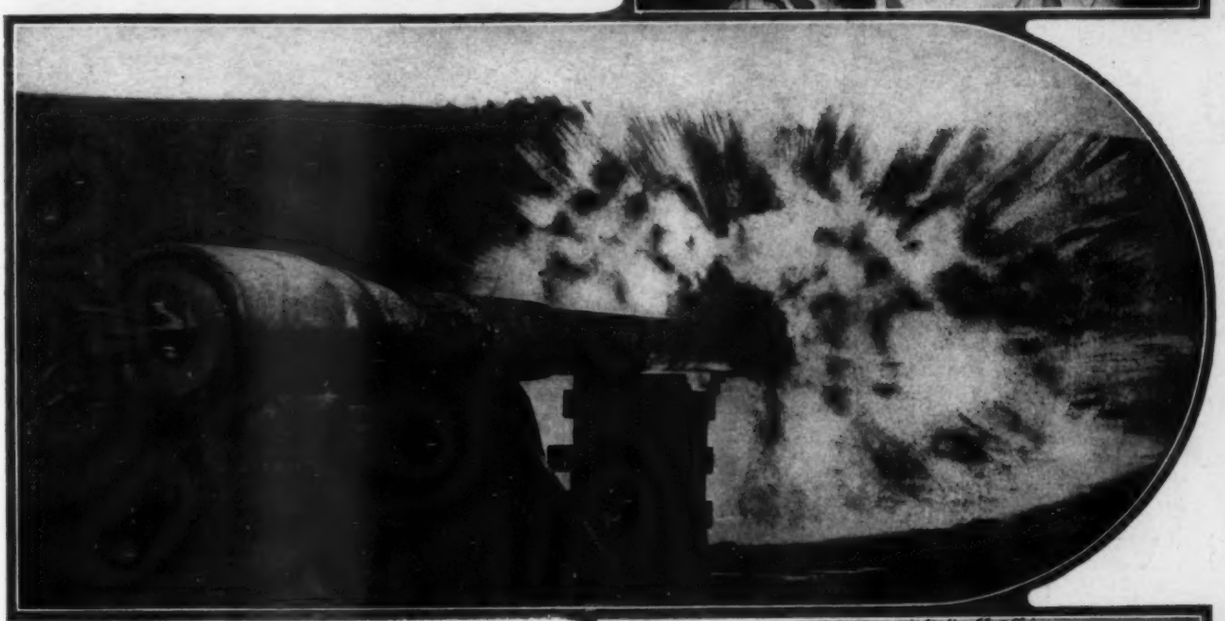
The Terrible Energy of Explosives

THE terrible power of modern artillery has shown us, more forcibly than ever, the tremendous power of modern explosives. A machine capable of hurling a ton of metal over twenty-odd miles of intervening sea or country is indeed well nigh a miracle; while the new long-range German cannon, having a range of more than seventy miles, while its shell attains a probable height of more than twenty-four miles (that is, above all the dense strata of our atmosphere), is almost incredible.

The universal fact about energy is its incessant transformation, upon which the whole activities of the universe depend. All forms of energy, light, heat, and motion, are different forms of the same thing. The firing of a big gun, for example, shown in the illustration, is perhaps the most remarkable example which science can offer of the transformation of matter into motion, brought about by the letting loose of the pent-up gases in the explosive charge. The terrible concussion of the air is ordinarily invisible, but can be partially caught upon the plate of the camera, and can be both heard and felt!

One of the great objects of inventors of explosives has been to introduce into explosive substances something which will not be lost as heat, hence will keep down the temperature of the gun barrel. For this purpose, experiments were subsequently made with substances such as derivatives of the cyanamide used for fertilizer, of urea, and of guanidine, the introduction of which, it is claimed, will not only lower the temperature within the gun barrel, without diminishing the ballistic force of the explosive, but will at the same time diminish the amount of smoke. There is also a tendency to pass away from gun cotton and nitro-glycerin to other nitro-derivatives of organic compounds, such as the toluenes, and chlorine derivatives, such as the chlor-hydrines. There is also a marked tendency to use, in the manufacture of explosives, substances hitherto wholly unknown in the industry, substances such as aluminium, sodium, calcium carbide, ferro-silicon, etc.

The energy derived from a chemical explosion is perhaps the most terrible in the world.

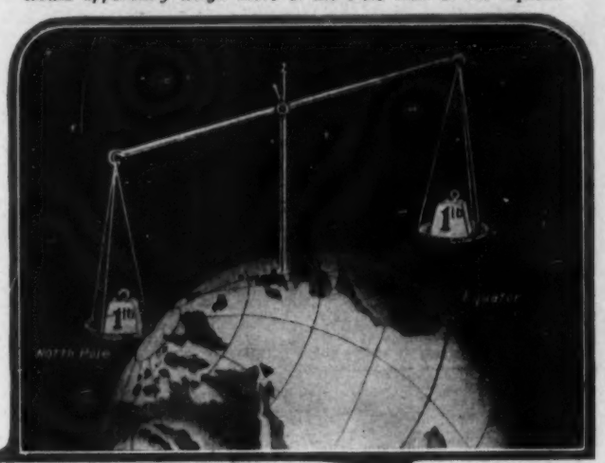


The tremendous force of our modern explosives is here depicted. The gases liberated from the propelling charge of a high-powered gun may here be seen

Why a Pound Weighs More at the Pole Than at the Equator

PERHAPS the old joke, "Which weighs heavier—a pound of feathers or a pound of lead?" is about to come into its own again! For science has now demonstrated that a given mass of matter, having, supposedly, a uniform and exact weight, is neither uniform nor exact; but that a "pound," for example, will weigh less than a pound at the equator, and more than a pound at the pole! According to its relative position on our earth, its weight varies, just as temperatures of boiling water vary, according to the height of the fluid above sea level.

A huge scale placed on our earth, one arm of which would reach to the North Pole and the other to the Equator, shows how a weight would apparently weigh more at the Pole than at the Equator

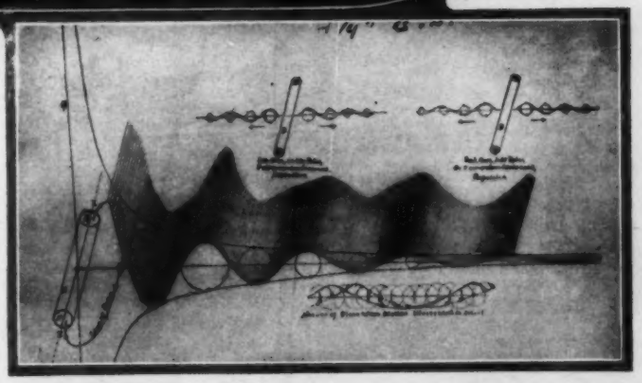


If we could construct an enormous pair of scales, one arm of which hung over the north pole and the other over the equator, and we were to place a pound weight in each scale, we should find that the weight at the north pole would pull down the scale pan—thus showing that it was the "heavier" of the two. The principle of the lever would show this. "Give me a large enough lever," said Archimedes, "and I will move the earth." Given a large enough lever, and this astonishing experiment could be demonstrated.

Of course, we cannot actually conduct such an experiment. Like most facts in physics, nowadays, it exists only on paper; but is none the less true for all that. Mathematics enables us to prove many problems incapable of actual experimental solution.

The reason for this curious fact—that a weight will be relatively more at the pole than at the equator—is merely this: The earth is slightly flattened at the poles, and has a

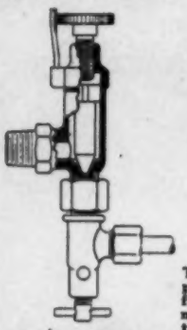
(*Continued on page 76*)



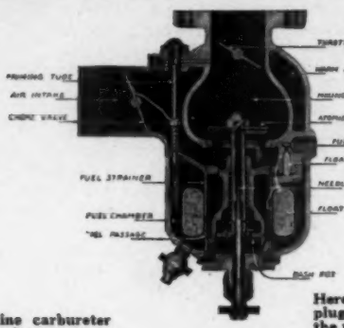
A flat magnetic wave showing its approximate character and also the cause of attraction and repulsion

New Things for Motor Boatmen

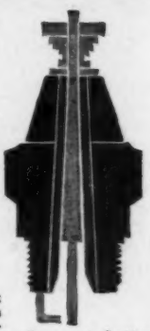
Each month new parts, attachments and fittings, interesting and invaluable to owners of large and small motor boats, are added to the devices already on the market. Announcements of these articles come to us in such numbers that in order to introduce all of them to our readers we have been obliged to omit descriptions and publish only illustrations with short explanatory captions. In doing this, however, we urgently invite our readers to write us for complete information, as we shall take the greatest pleasure in providing it, together with the manufacturers' names and addresses. Do not hesitate to ask us, as we have made special arrangements to take care of this branch of our correspondence and are able to give you accurate information with the greatest promptness.



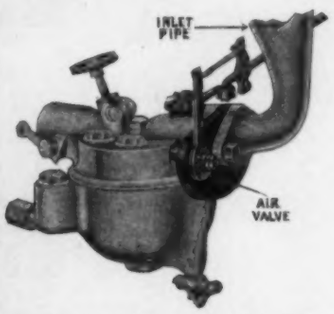
This water vaporizer differs from the ordinary type in that a weighted valve allows the water spray to enter the manifold only at high speed or full load, the amount of water admitted being controlled by varying the lift of the valve



Here is a gasoline carbureter that embodies in its construction a number of novel features. When starting the motor the choke valve is closed, which automatically depresses the priming tube and feeds the gasoline directly to the mixing chamber. When running the fuel is atomized through small openings in the edge of the air valve head, and the action of this valve is steadied by a dash pot in the bottom of the float chamber, preventing pounding or clattering against the seat. A strainer in the float bowl keeps dirt and sediment out of the gasoline passages

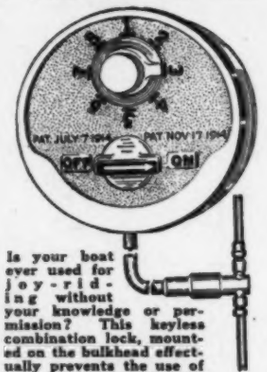


Here is a spark plug in which the mica insulation extends to the very bottom edge of the shell and prevents any possibility of a short circuit



This auxiliary air inlet can be installed on any carbureter at the flange joint and is connected to the throttle valve control rod by a link so that they operate together. With this valve no trouble is experienced from excess air when running at reduced speeds

Those who have tried to get just the right thickness of shim to make a bearing a perfect fit will appreciate this material. It is made up of a number of very thin sheets of brass held together by a metallic binder. The individual sheets are peeled off until the proper thickness is reached

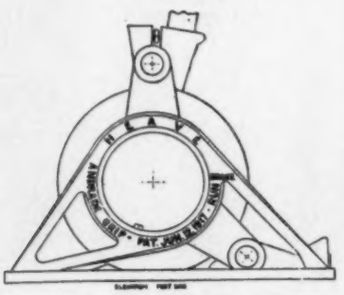


Is your boat ever used for joy-riding without your knowledge or permission? This keyless combination lock, mounted on the bulkhead effectually prevents the use of your boat. It locks the gasoline supply, ignition circuit, and self-starter at one operation

A real searchlight is a valuable addition to any boat's equipment. This lamp has not only the usual vertical and horizontal motions but can also be raised and lowered. The distribution of light can be varied at will from a powerful beam with a range of nearly 1,000 yards to a widely diffused light for use close aboard the boat

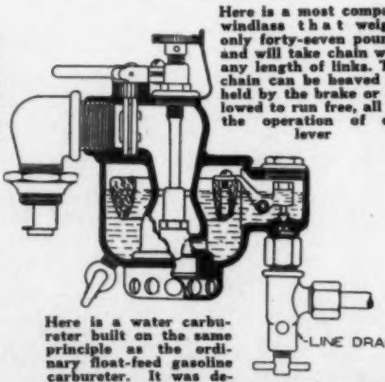
In this aerial drive for boats the motor is located well down in the hull keeping the center of gravity low and thus overcoming the tendency to have a top-heavy outfit

How often have you wanted a record of the different speeds your boat made on a certain trip? Here is an instrument that can be installed anywhere aboard the vessel and will keep an accurate record of the speed on a revolving chart



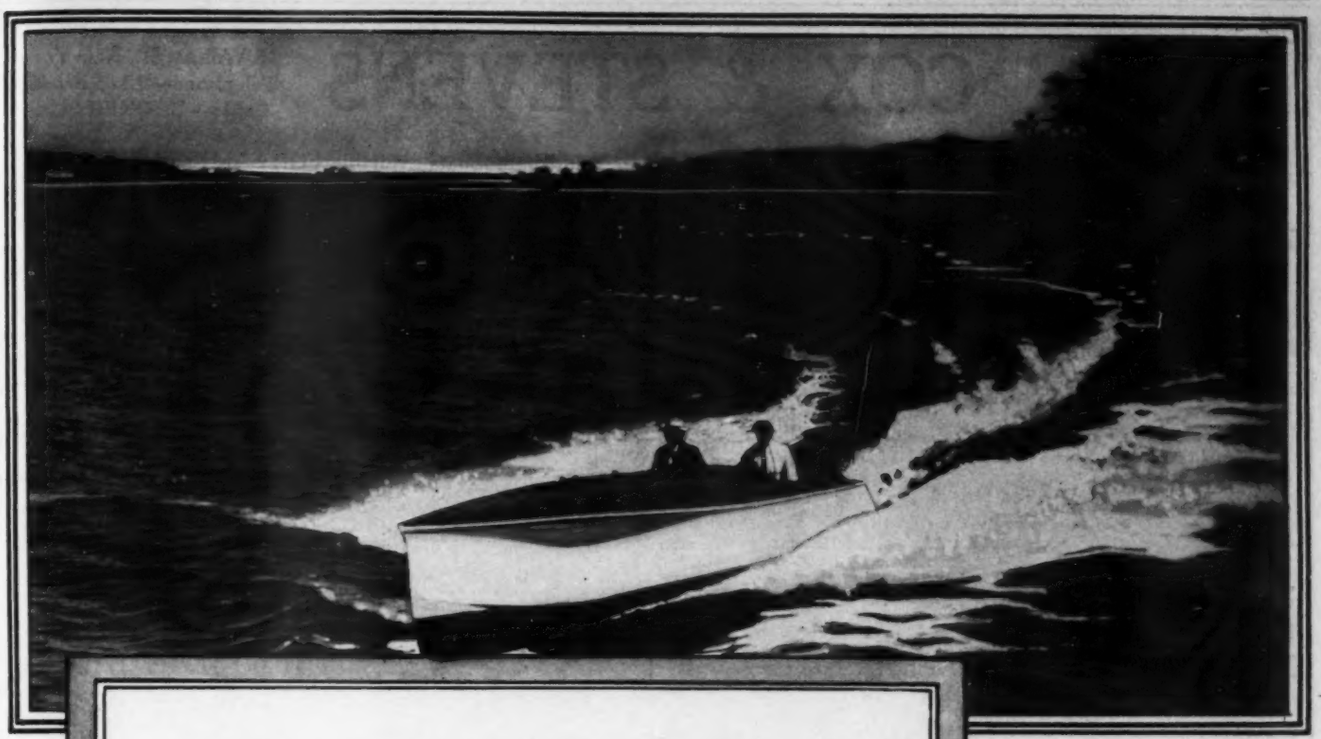
Here is a most compact windlass that weighs only forty-seven pounds and will take chain with any length of links. The chain can be heaved in, held by the brake or allowed to run free, all by the operation of one lever

Does the shut-off in the gasoline line of your boat leak? Here is a carefully ground and fitted cock that has a packing around the stem and a tension spring to keep it tight



Here is a water carbureter built on the same principle as the ordinary float-feed gasoline carbureter. It was designed especially for use on gasoline motors operating on kerosene or distillate and can be regulated to feed just enough moisture to prevent pounding when operating under full load. A drain is provided both in the float bowl and at the water connection so that the entire system can be drained during freezing weather

Do not fail to write to the editor if you desire information concerning any of the above new things



THE ALMA, owned by L. S. Straight, Fonda, Iowa. Speed 35 miles per hour. Built by John Hafer, Spirit Lake, Iowa. Finished with Valspar

35 miles an hour can't harm Valspar!

High speeds play havoc with ordinary varnish because it is unable to withstand the constant wetting and the tremendous friction soon wears off the entire coating.

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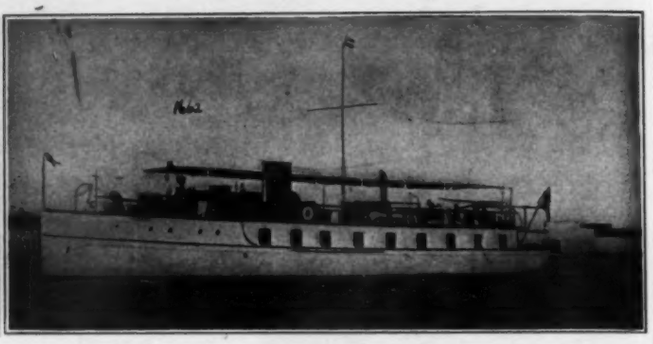
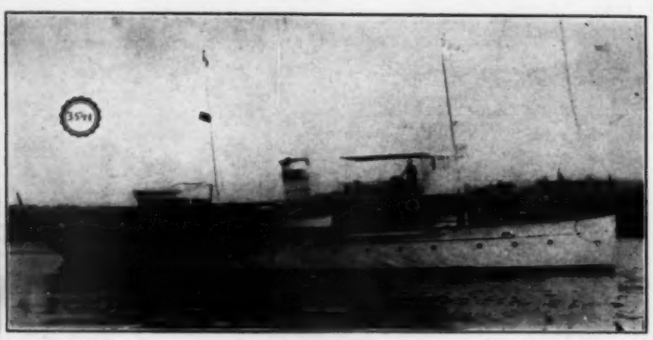
We have a complete list of all steam and power yachts, auxiliaries and houseboats available FOR SALE and CHARTER. A few are shown on this page. Plans, photographs and full particulars furnished on request.

No. 2366—For Sale—Particularly desirable steel, twin screw cruising power yacht; 126 x 18.6 x 6 ft. Recently built in best manner; exceptionally able craft. Speed 12-14 miles; two 125/150 H.P. 6 cyl. air-starting motors. Large deck dining saloon; main saloon, five staterooms, two bathrooms, etc., aft. All conveniences. Handsomely furnished. Cox & Stevens, 15 William Street, New York.

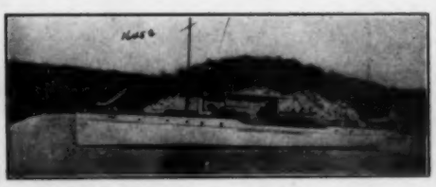


No. 1662—For Sale or Charter—Attractive 90 ft. twin screw gasoline houseboat; speed 10-12 miles. Large saloon, four staterooms, two bathrooms; all conveniences. Handsomely furnished. Cox & Stevens, 15 William Street, New York.

No. 148—For Sale—Steel, flush deck, steam auxiliary schooner yacht; 130 ft. overall, 110 ft. waterline, 26 ft. beam, 15.6 ft. draft. Speed under power 9 knots; compound engine; electric lights; all conveniences. Extremely able craft; heavily constructed. Cox & Stevens, 15 William Street, New York.



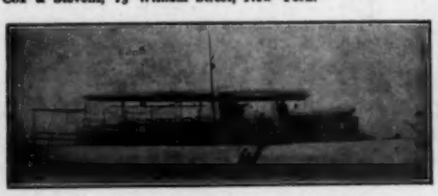
No. 3541—For Sale or Charter—Particularly desirable 100 ft. steel twin screw, cruising power yacht. Practically in commission; very attractively finished and furnished. Speed up to 15 miles; two 6 cyl. air-starting and reversible standard motors. Fitted with every convenience. Large dining saloon and social hall on deck; five staterooms, bath, two toilet rooms, etc. Without doubt finest craft of type and size available. Cox & Stevens, 15 William Street, New York.



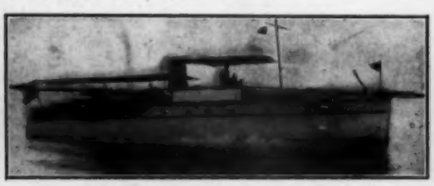
No. 1645—For Sale—70 ft. off-shore gasoline cruiser; recently built by well known firm. Speed 11-13 miles; 6 cyl. Winton motor. Main saloon and galley forward; two double staterooms and bathroom aft. Price exceptionally low. Unusual opportunity. Cox & Stevens, 15 William Street, New York.

No. 2888—For Sale—Twin screw Diesel power yacht; 110 x 18 x 6 ft. Speed 12-14 miles; two 150 H.P. 6 cylinder Craig-Diesel motor. Dining and main saloons; four staterooms, bath, four toilets, etc. Very economical to operate. Cox & Stevens, 15 William Street, New York.

No. 1070—For Sale—Modern gasoline cruiser; 60 x 11.16 x 3.9 ft. Speed 11 miles. Dining saloon forward; main saloon (convertible into stateroom) and double stateroom aft. Very able, desirable craft. Best construction. Low price. Cox & Stevens, 15 William Street, New York.

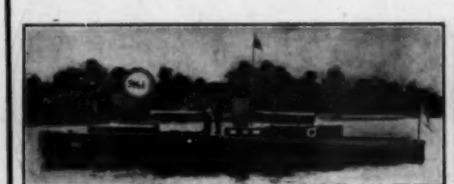


No. 1130—For Sale or Charter—Roomy and able gasoline cruiser, 70 x 13.6 x 3.6 ft. Speed 11-13 miles; 6 cyl. Winton motor. Dining saloon, three staterooms, bath, main saloon, etc. Low figure accepted. Cox & Stevens, 15 William Street, New York.



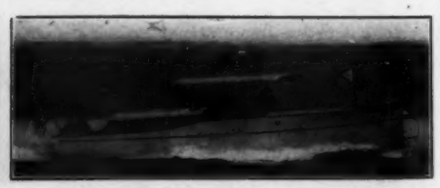
No. 2560—For Sale—Fast, V-bottom, twin screw power cruiser; 60 x 13 x 3 ft. Built 1917. Speed up to 18 miles; two 6 cyl. Sterling motors. Double stateroom forward; roomy saloon aft with separate galley; two toilet rooms (one with Sitz bath). Low price for quick sale, Cox & Stevens, 15 William Street New York.

No. 2830—For Sale—Modern 50 ft. bridge deck cruiser. Speed 11 to 12 miles; 40/50 H.P. 20th Century motor; electric lights, etc. Saloon and separate galley forward; double stateroom and toilet aft. In commission. Low price. Cox & Stevens, 15 William Street. New York.



No. 3461—For sale or Charter—Twin screw express day cruiser; 65 x 9 x 3.3 ft. Speed up to 25 miles; two 6 cyl. Van-Blerck Motors (new 1917). Accommodations for four in owner's party. Best construction. Cox & Stevens, 15 William Street, New York.

No. 2826—For Sale or Charter—Cruising power yacht; 85x 1424.6 ft. Speed 11-13 miles. Dining saloon, two double staterooms, bath, two toilets; independent lighting plant, etc. Large deck space. Exceptional opportunity. Cox & Stevens, 15 William Street, New York.



No. 3477—For Sale—Fast, bridge deck cruiser; 43 x 9 x 3 ft. Built 1917 by well known firm. Speed 17 miles; 6 cyl. Speedway motor, electric lights, etc. Double stateroom forward; saloon aft with two transoms. Two toilet rooms. Price reasonable. Cox & Stevens, 15 William Street, New York.

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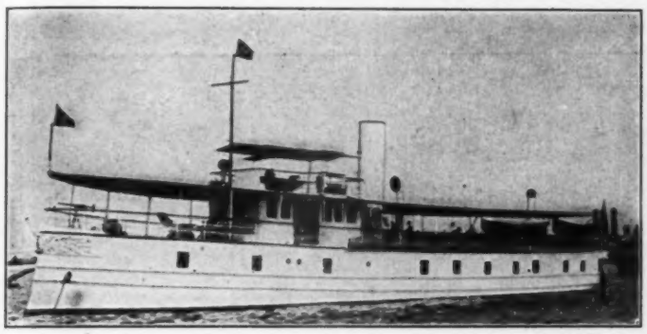
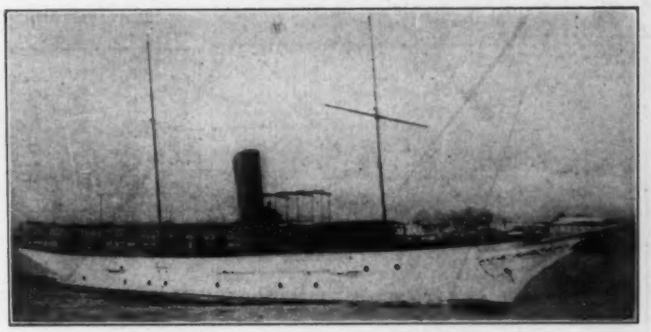
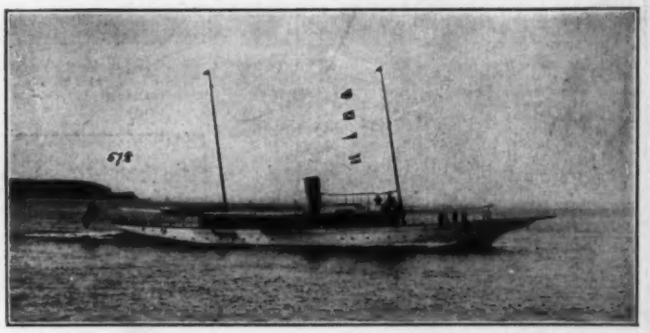


No. 243—Sale—Charter—Twin screw steam houseboat, 116 ft. x 21 ft. x 4 ft. draft. 4 staterooms, 3 bathrooms, dining saloon and smoking room.

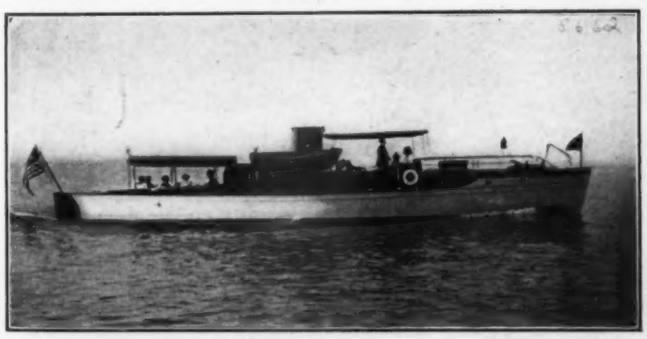


No. 7987—Sale—Charter—106 ft. cruising motor yacht; speed 13 knots; 4 staterooms, bathroom, main saloon, deck dining saloon, etc. Full equipment.

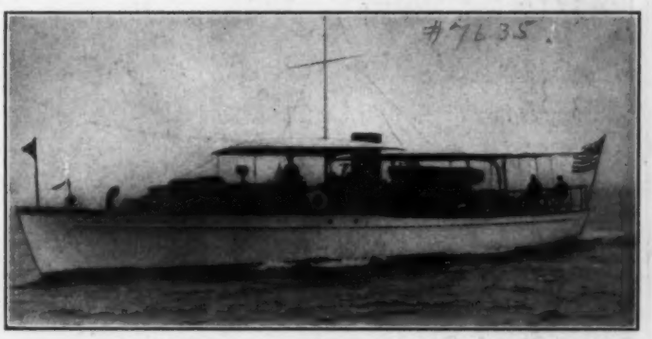
No. 8986—Sale—Modern, fast day Cruiser, 55 ft. x 8 ft. 9 in. x 3 ft. Speedway motor. Speed 22 miles.



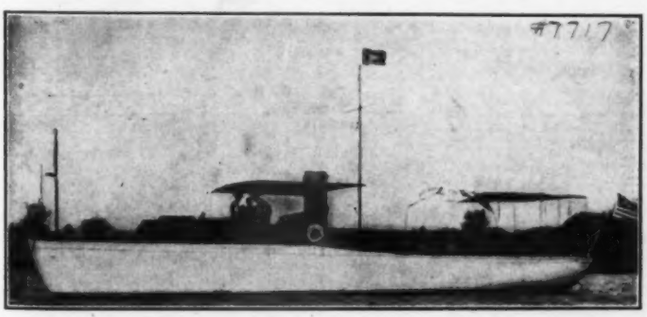
No. 18—For Sale—Estate anxious to sell fast cruising steam yacht, 147 ft. x 17 ft. x 7 ft. 3 staterooms, bathroom, dining saloon, sitting room.



No. 8662—Sale—Twin Screw Cruiser. Speedway motors, new 1916. Speed 15 miles. Stateroom, saloon, large cockpit and bridge deck.



No. 7635—Sale—Cruising Motor Yacht, 66 ft. x 13 ft. 4 in. x 4 ft. Standard motor 2 staterooms, bathroom, saloon, etc.



No. 7717—Sale—Raised Deck Cruiser, 60 ft. x 11 ft. x 3 ft. 6 in. 50 H.P. Speedway motor. Saloon, stateroom, galley, etc.

No. 8713—For Sale—Attractive Day Cruiser, 50 ft. x 8 ft. 3 in. x 3 ft. 1 in. draft. 6 cylinder Holmes motor. Speed 13 miles.

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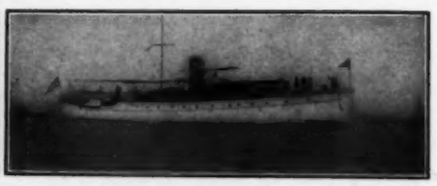
We have a most complete and up-to-date list of steam yachts, power yachts of all sizes, sail, auxiliary and houseboats on file in our office, kept constantly up-to-date by a thorough and comprehensive canvass of the entire yachting field from time to time. We are in a position to submit full information on any type of boat upon request.

FOR SOUTHERN CRUISING this Winter we offer a number of very desirable POWER HOUSE BOATS and POWER YACHTS which are specially adapted for FLORIDA waters. Last season a great number of clients were much disappointed in not being able to secure for charter a suitable POWER HOUSE BOAT or POWER YACHT owing to the great demand. Yachting this coming WINTER SEASON promises more activity than ever before—so—CHARTER A BOAT NOW AND BE ASSURED OF ONE THIS WINTER.

We can render invaluable assistance in expert appraisals, supervision of alterations and estimates.

No. 3749—For Sale and Charter—Attractive twin screw motor yacht; five staterooms, two bath rooms, large deck saloon. Interior finish mahogany; powered with Standard motor, speed twelve miles. Gielow & Orr, 52 Broadway, New York City.

No. 5489—For Sale—64 foot express cruiser. In excellent condition. Can be purchased at bargain. Act quick. Make inspection immediately. Gielow & Orr, 52 Broadway, New York City.



No. 4591—For Sale—126 foot twin screw steel motor yacht. Most successful cruiser. Designed by us. Five staterooms, Speedway engines. Gielow & Orr, 52 Broadway, New York City.

No. 5029—For Sale—Most attractive 76 foot twin screw motor yacht built 1917; Winton motors, one of most able cruisers available. Three double staterooms, interior finish mahogany. Price attractive. Gielow & Orr, 52 Broadway, New York City.

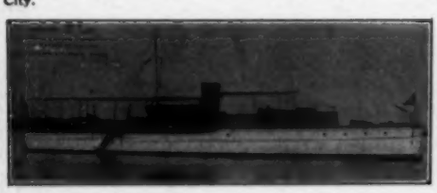
No. 3710—For Sale—Popular twin screw off shore cruiser. 90 foot by 17 foot by 4 foot. Standard motors. Six staterooms, three bathrooms. Gielow & Orr, 52 Broadway, New York City.

No. 3973—For Sale—Attractive shoal draft 80 foot twin screw cruiser, large accommodations, interior finish mahogany; Sterling engines, speed twelve miles, up-to-date in every particular. Gielow & Orr, 52 Broadway, New York City.

No. 4183—For Sale—55 foot cruiser with beam 12.6 Standard engine, all perfect condition, most of interior furnishings new 1917; large double stateroom and main saloon. Owner anxious to sell. Price reasonable. Gielow & Orr, 52 Broadway, New York City.

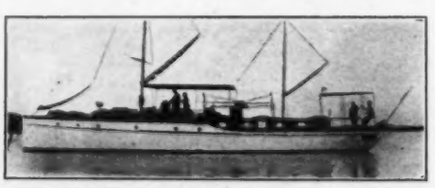
No. 2841—For Sale—Auxiliary centerboard yawl. 35 feet overall, 30 feet waterline, 12 feet beam, 3 feet 5 inches draft. In excellent condition. Sterling engine. Gielow & Orr, 52 Broadway, New York City.

No. 706—For Sale—Most attractive 71 foot auxiliary keel yawl. Sails new 1916. Fast sailer. Three staterooms. Price reasonable. Gielow & Orr, 52 Broadway, New York City.



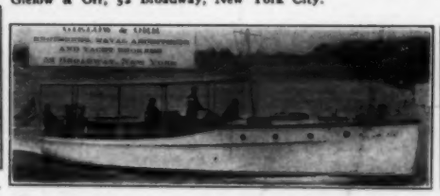
No. 6053—For Sale—Handsome 75 foot twin screw motor yacht. Built 1917. 20th Century motor. Mahogany and white. Three staterooms. Gielow & Orr, 52 Broadway, New York City.

No. 5951—For Sale—High grade 40 foot express cruiser. Hand V bottom. Speed up to 23 miles. Van Blerck engine. Gielow & Orr, 52 Broadway, New York City.



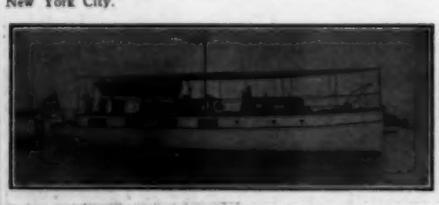
No. 4606—For Sale—Attractive 64 foot cruiser, beam 12.6, exceptionally able seaboat, 6 cylinder motor, speed 11 knots; two staterooms besides a main saloon, all in excellent condition. Price reasonable. Gielow & Orr, 52 Broadway, New York City.

No. 5565—For Sale—Bargain Price—82 foot cruising houseboat, 30 in. draft, now partly in commission Florida. Accommodations give four staterooms, besides main saloon and deck dining saloon; built 1916. $6,000 spent in improvements last year, all in perfect condition, opportunity to obtain desirable Florida cruiser at very low price. Gielow & Orr, 52 Broadway, New York City.



No. 5585—For Sale—This attractive 45 foot bridge deck Elco cruiser, comfortable stateroom, large main saloon, built 1916; Standard motor, electric lighted, fully equipped, all perfect condition. Price reasonable. Gielow & Orr, 52 Broadway, New York City.

No. 5980—For Sale—This 60 foot express yacht built 1917. Equipped with Sterling engine. Speed up to 16 miles. Gielow & Orr, 52 Broadway, New York City.



No. 5225—For Sale—52 foot flush deck cruiser. Standard motor. Private stateroom. Bathroom. Excellent proposition. Estate must be settled. Gielow & Orr, 52 Broadway, New York City.

No. 5272—For Sale—Bargain—50 foot bridge deck cruiser in commission; two staterooms, electric lighted, interior finish mahogany, launch tender. All perfect condition. Low price. Gielow & Orr, 52 Broadway, New York City.

No. 4527—For Sale—Desirable 40 foot cruiser, 10 foot beam, Sterling engine; stateroom and main saloon all perfect condition, fully equipped for cruising. Price reasonable. Gielow & Orr, 52 Broadway, New York City.

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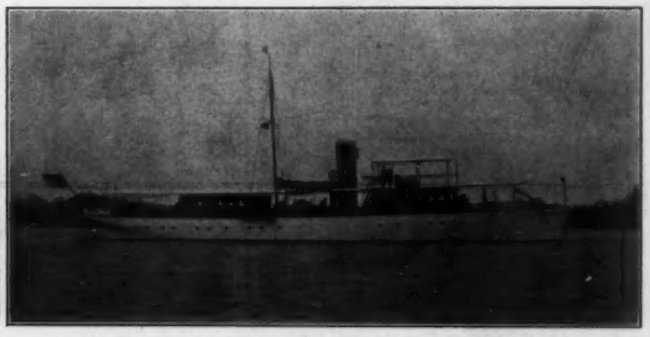
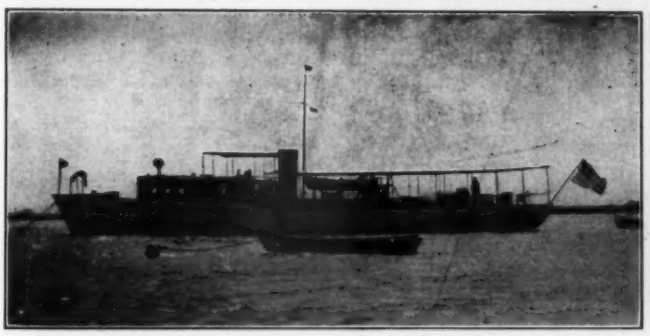
We have a complete list of Yachts of every description for sale and charter. **Plans, Photos and full particulars furnished on request**

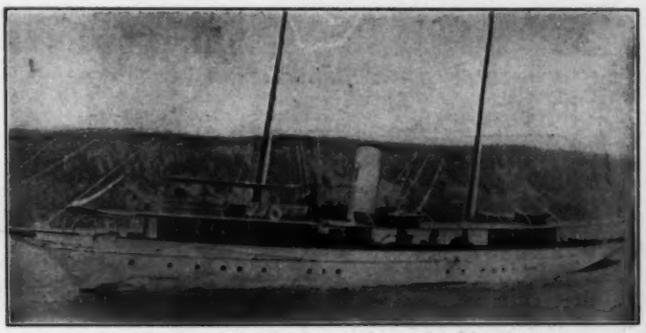
No. 1704—Modern, twin screw cruising power yacht, 98 x 16 x 4. Built 1911; speed 14/16 miles; two 100/125 H.P., 6 cyl. Standard engines. Accommodation consists of 5 staterooms, dining saloon, two bathrooms, galley, etc. William Gardner & Co., 1 Broadway, New York.



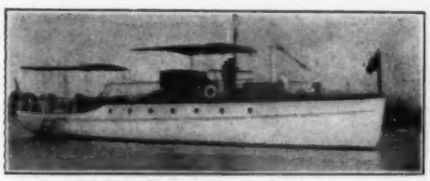
No. 646—For Sale or Charter—Steam yacht 123 ft. x 17 ft. x 6 ft. draft. 5 staterooms, 3 bathrooms. Dining saloon and social hall on deck.



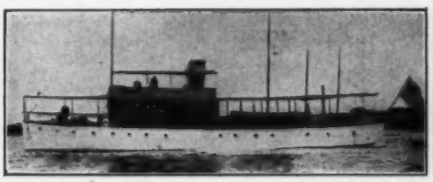
No. 1081—For Sale—Twin screw, 90 ft. power yacht; splendid accommodation. Recently overhauled and 2 new Standard engines, 4 cylinder, 75 h.p. each, installed 1916. Exceptionally able and fully found.



No. 238—For Sale—Steel steam yacht, 170' x 21' x 8' draft. Large dining saloon, social hall and smoking room on deck; 5 staterooms, 3 bathrooms, etc. Completely equipped.

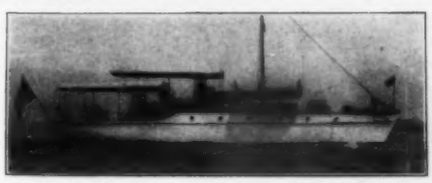


No. 1908-L.—Raised deck cruiser, 56 ft. by 12 ft. 6 in. by 3 ft. 9 in.; Standard engine; speed 12 miles. Has stateroom, main saloon with transom berths, separate galley, etc. Complete equipment.

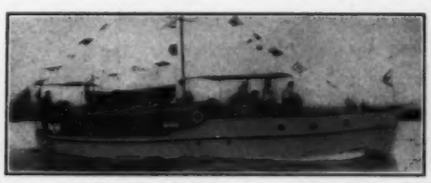


No. 1821—Flush Deck Power Yacht, 90 x 15.3, two 60 H.P. motors, 3 staterooms, etc.

No. 924—Power Yacht, 92 ft., 100/125 H.P. 20th Century motor, splendid deck space.

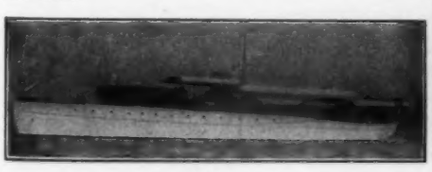


No. 1270—For Sale or Charter—Raised deck cruiser 55 x 12 x 4.6. Standard engine 32/37 H.P. Has two staterooms, main saloon, galley, etc. William Gardner & Co., 1 Broadway, New York.

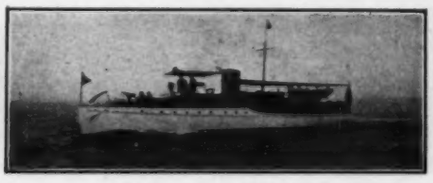


No. 2355—Bridge deck cruiser, 45 x 9.6, Lamb motor, 24 H.P.; quick sale desired.

No. 2386—New Patrol type, 54 x 11.2, eight cylinder Van Blerck, speed 17 miles.



No. 1037—Diesel Power Yacht, 110 x 18, two 6 cylinder 150/180 H.P. engines, low fuel cost.



No. 1738—Raised Deck Cruiser, 65 x 11, six cylinder motor, good accommodation.

No. 2358—New Express Cruiser, 45 ft., eight cylinder, 200 H.P. Van Blerck, speed 22 miles.

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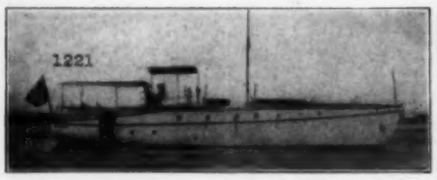
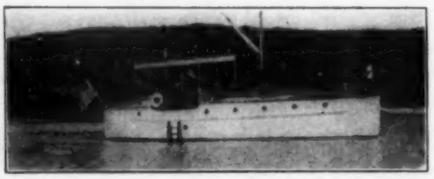
Our list comprises all the available yachts for sale and charter. Below are a few of our offerings. If none of these appeals to you, write us your requirements. Our knowledge of the yachts we offer, and our 25 years' experience in the business, insure satisfaction to any one buying or chartering a yacht through this office.

SEND FOR OUR CATALOGUE



1221—55 foot cruiser. Stateroom and main cabin sleep seven. Speed 10 miles. Price attractive.

1977—30 foot Elco express runabout. Speed 22 miles.

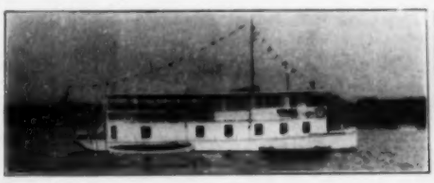


1067—40 foot cruiser. Stateroom and main cabin sleep four. Speed 8 miles. Price attractive.

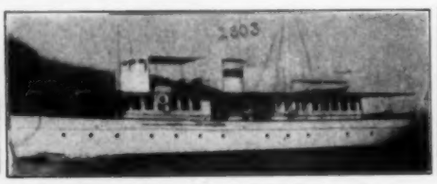
1605—40 foot cruiser. Sleeps four. Speed 11-12 miles. Price attractive.

4270—100 foot keel schooner. Three double staterooms, main saloon, bath, etc.

1979—25 foot runabout. Built by Lawley. Speed 18 miles. Owner ordered to France. Will take $600 for quick sale.



1665—70 foot twin screw houseboat. Four staterooms dining saloon, social hall, bath, etc. Speed 8½ miles. Price attractive.



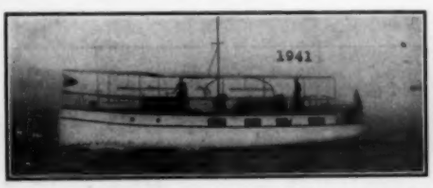
1303—100 foot twin screw power yacht. Splendid accommodations. Speeds up to 14 knots.

931—60 foot cruiser. Double stateroom and main cabin sleep five. Speed 11-12 miles.

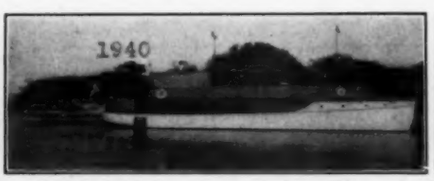
990—60 foot cruiser. Three staterooms, saloon, etc. Speed 10 knots.

1109—For Charter—80 foot power yacht. Two double staterooms, main cabin, dining saloon, bath, etc. Speed 13 miles.

4287—90 foot power houseboat. Five staterooms, saloon, dining saloon, bath, etc. Speed 11 miles. Price attractive.



1941—52 foot houseboat cruiser. Large saloon and double stateroom, etc. Speed 9 miles.



1940—Sale or Charter—65 foot cruiser. Three double staterooms, saloon, bath, etc.

1060—50 foot cruiser. Stateroom and saloon sleep six. Speed 14 miles.

1958—60 foot speed cruiser. Speed 15-17 miles.

1978—40 foot express cruiser. Stateroom and main cabin sleep four. Speed 16-18 miles.

1456—42 foot cruiser. Splendid proposition. Speed 10 miles. Price attractive.

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The rate for "For Sale" and "Want" advertisements is 3 cents per word, minimum 75 cents. If an illustration is used, the charge is as follows, which includes the making of the cut:
Cut one inch deep, one column wide..... $2
Cut 1½ inches deep, 1½ columns wide..... $5
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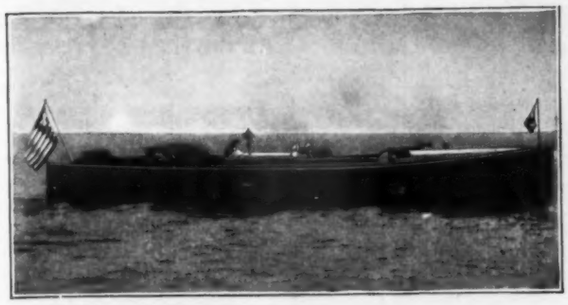
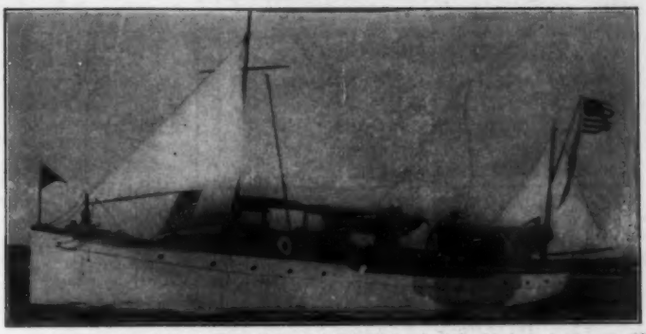
Before you buy or before you sell examine the exceptional buying and selling opportunities under the heading. They comprise the best offer of the month. Please mention MoToR BoatinG.



FOR SALE—The above handsome mahogany Runabout. Used only two weeks. Owner now in France. Power plant, 6 cyl. Van Blerck. Speed 30 miles hour. Complete, ready for service. Will sell for half its value. Address W. L. Masters, 229 No. State St., Chicago, Ill.



No. 4079—For Sale—Gasoline Cruiser; length 70 ft.; built by Lawley; three years old but little used; 6 cylinder Winton engine; has auxiliary sail power; a very desirable yacht. FRANK BOWNE JONES, Yacht Agent, 29 Broadway, New York.
YACHTS OF ALL TYPES FOR SALE AND CHARTER

FOR SALE—Beautifully finished mahogany hydroplane runabout 24 ft. x 6 ft., seats six. Has wicker chairs, aluminum fittings. In perfect condition, used but little. Engine E-4 special Van Blerck, 4 cylinders, Leese Neville starter. Willard batteries, electric running lights, brass clock, revolution counter, bronze shaft and wheel. Makes 28 to 30 miles per hour. Owner now in U. S. Aviation service 10 has no use for boat. Price $1800.00 F.O.B. cars Saginaw which is much less than present price of engine alone. Immediate delivery. Good sea boat. P. O. Box 815, Saginaw, Michigan.

We have 85 used and rebuilt engines from 1 to 90 H.P. $5,000 worth of boat and engine accessories of every description. Be sure to get our list before buying. Jesiek Boat Co., Grand Rapids, Mich.

FOR SALE—A speedy, safe, comfortable cruiser just thoroughly overhauled and her engines rebuilt has been put in commission for her owner's use. She is in the best of shape. Her outfit is unusually complete. New cables, anchors, awnings and motor tender. No more satisfactory boat afloat. She sleeps nine. Her aft deck seats twenty. Her dimensions (53 ft. x 11 ft. 10 in. x 3 ft. 2 in.) are ideal for a one man boat. Will be sold at a bargain, but not given away. The owner desires a larger boat. Address: John Townsend, Essex, New York.

FOR SALE—Motor boat, Racine built, 30 ft. x 6 ft. x 6½ ft. Finely finished. 3 cylinder 10 H.P. Fay & Bowen motor. Apply Mrs. C. E. Field, Hector, N. Y.

A few medium and high speed, one, two, four and six cylinder, four-cycle marine motors, new or rebuilt. Reliance Motor Boat Co., 210th Street and Harlem River, New York City.

Cottages for rent or sale. Also number of used boats and engines. Prices attractive. Correspondence solicited. Sheldon Cole, Oden, Mich.

Motor Boat for sale—Thirty feet long, Mahogany deck and trim, 50 horsepower Van Blerck engine. Seating capacity 11. In splendid condition, apply H. Howard Shaver, 157 Bay Street, Toronto.

WANTED 24 to 25 ft. V-bottom hull complete with all equipment less motor. Must be bargain and in good condition. J. F. Charley, Evansville, Ind.

We have a number of new 18 ft. Family Runabout Hulls complete with gasoline tank, engine bed and metal shaft log. Complete for $75.00. Sixth City Specialty & Mfg. Co., Cor. West 9th and Frankfort Ave., Cleveland, Ohio.

32 foot, 9 foot beam cruising launch, has 25 horse Palmer heavy duty engine, 10 miles an hour. This cost $1,600, will sell for $650. Also 22 foot, 5 foot beam runabout, 25 horse Twin engine. Clutch complete, 18 miles an hour. Cost $900, will sell for $350. Will also sell heavy duty 25-30 horse Palmer, Bosch magneto, Clutch complete. All as good as new. Cost $1,100, will take $550. Dennis J. Comisky, Freeport, N. Y. Phone 86 Freeport.

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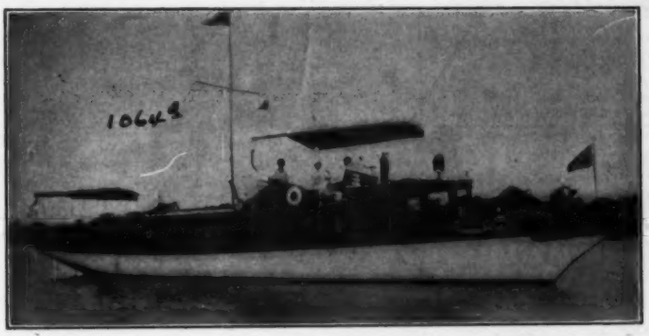
I have the following bargains in rebuilt engines and new engines.

100 H.P. 6 cylinder 8 x 10 Standard practically new	$3900.00
40 H.P. 4 cylinder Speedway, rebuilt	1600.00
40 H.P. 4 cylinder Globe Late Model, rebuilt	1600.00
2-25 H.P. 2 cylinder Mason Jager right and left, new	1200.00
12 H.P. 2 cylinder Globe, rebuilt	300.00
17-25 H.P. 4 cylinder Sterling, electric starter, new	700.00
24 H.P. 4 cylinder Lamb rebuilt	450.00
16 H.P. 2 cylinder Frisbee, rebuilt	375.00
10 H.P. Lathrop	125.00
6 H.P. Bridgeport	100.00
6 H.P. Lathrop	100.00
30 H.P. Demoy 3 cylinder	150.00
10 H.P. 2 cylinder Bridgeport	175.00
10 H.P. 2 cylinder Bridgeport	100.00
3 H.P. Stanley	40.00

These engines all have shaft and propellers, crated, ready for shipment, F. O. B. Boston, all in excellent condition ready to run. Distributor Standard Bridgeport and Fay & Bowen engines. L. T. Carey, 111 Haverhill St., Boston.



No. 1064—Offer wanted—Particularly desirable motor yacht; 63 x 12.6 x 3.10 ft. Speed 11-13 miles; 50/54 H.P. 6 cyl. Standard motor. Accommodations for six on berths in pilot house and large saloon. Mahogany finish throughout. Independent electric lighting plant. Large deck space. Cox & Stevens, 15 William Street, New York.

1	H.P. Pierce	$22
2½	H.P. Giant	32
3	H.P. Pierce	38
5	H.P. Termatt-Monahan	45
12	H.P. Barber heavy duty with propellor equipment complete	95

ALL THE ABOVE ARE SINGLE CYL. ENGINES.

6	H.P. Gray two cyl.	$65
10	H.P. Truscott two cyl. and propellor	115
18	H.P. Superior two cyl. heavy duty with propellor	135
30	H.P. Barber 3 cyl. 4¾ x 4¾ speed boat engine with Bosch high tension magneto	145
24	H.P. Waterman 4 cyl. 4 x 4 speed boat engine	115
4	cyl. four cycle 6½ x 8 heavy duty, no gear or propellor. Nearly new	485
6	cyl. KISSEL 4 x 4½ auto engine with electric starter and generator.	

Also hundreds of other four and six cyl. auto engines in all sizes and makes. Large stock of magnetos, coils, carburetors, oilers, etc., at very low prices.

BADGER MOTOR COMPANY, Milwaukee, Wis.

FOR SALE—Dory model runabout. A dandy. 25 H.P. engine. Speed 12-15 M.P.H. New outfit. New double spray hood. Sale and comfortable and the fastest dory afloat. Will sell at a very reasonable figure. Dimensions 22 x 6 x 1½. Address: B. N. Batchellor, St. Albans, Vermont.

Cabin Cruiser, 65 by 12 by 3-9. Cabin amidships with forward and after decks. Cabin well ventilated making her especially suitable for warm weather or Florida cruising. Luxuriously furnished and completely equipped with the best thruout. Two staterooms and large saloon, sleeping 8. Roomy crew's quarters under forward deck. 6 cyl. Sterling engine, all controls to wheel, speed 14 m. Launched in July, 1917. If you want a real cruiser at a fair price address O. W. Nelson, 420 Gardner Bldg., Toledo, Ohio.

No. 2663—For Sale or Charter—Houseboat (located on St. Lawrence River); 102 x 24 ft. Very attractively furnished. Large dining and main saloons; nine staterooms; two bathrooms; three toilets, etc. Price attractive. Cox & Stevens, 15 William St., New York.

WANTED—Medium duty 30 to 50 H.P. 4 cycle marine engine with clutch, jump spark ignition, starter and lighting system. State name of builder, when built, number of cylinders, speed, with condition and price. Box 6, care MoToR BoatinG.

FOR SALE or would Exchange for Auto—N. Y. Y. C. Thirty Type Aux. Sloop "Fern." Only two owners with finest care. Cost $32,000. New in 1909 and is absolutely as good now. 42 feet o.a., 30 feet w.l., 9.5 feet beam, 7 feet draft, with 3000 lb. Lead or Keel and a 7-10 H.P. engine that runs under cockpit. Built by the best in the country of the finest heavy oak construction. Copper fastened and fittings. She is one of the fastest and most easily handled rough-weather boats afloat, having lost but two races out of thirteen matches. Has cruised from Chesapeake Bay to New Brunswick, Canada, and will stand up in any kind of weather. Cabin finished in mahogany with large locker space, sleeps four. Galley complete: Perfection oil stove refrigerator, cupboards and utensils. Toilet is white, forward. Two 50 gal. water and one 50 gal. gas tanks of copper. Sails 1000 sq. ft. area, complete, bronze blocks. Main sail new 1915. Large cockpit finished in mahogany. Full length awning. Screens for cabin and galley. Fully found with the best obtainable. 14 ft. natural finish Power Tender, also 18 ft. canoe. Was thoroughly overhauled in 1917, including motor, but was not in commission last year as owner was then and is now in the Navy. Box 10, MoToR BoatinG.

FOR SALE, 26 ft. Open Launch with hood	$225.00
35 ft. Glass Cabin Launch	200.00
2 H.P. Wisconsin little used O. Board Motor	40.00
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FOR SALE—Twenty-foot power boat. 5 H.P. Fay & Bowen engine. Apply J. H. Downing, Alton Bay, N. H., or S. E. Rollins, Lawrence, Mass.

SPECIALS—Ward Leonard Generators $8.00. Coils $5.00. Bosch Magnetos, 4 and 6 cylinder, $10.00. Master Vibrators $2.65. Leather Cushions $1 and $2 each. Presto Tanks $5.00. Hand Horns $1.85. Battery Charging Motor Generator Sets $30.00 each. Auto Motors, water cooled, 4 cylinder, $30.00. Buick, Hupp, Franklin, Continental and Buda Motors, all sizes, types and prices. Write for bargain bulletins. Johnston, West End. Pittsburgh, Pa.

MODERN 36 ft. SPEEDWAY built Sedan Runabout, with 6 cylinder, 50-66 H.P. SPEEDWAY motor. Speed 20 M.P.H. Varnished bright. Mahogany hull, cabin and interior joiner work. Toilet arranged under seat in cabin. Attractive boat available for immediate delivery. Apply to GAS ENGINE & POWER CO. and CHARLES L. SEABURY & COMPANY, Consolidated, Morris Heights, New York City.

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BARGAINS in boats are not plenty though boats for sale at bargain prices are. We offer bargains occasionally, but only occasionally, for a bargain is a scarce animal. Here are what we have today: If you are interested in a cruiser at six thousand that is actually worth ten thousand; or a runabout at one thousand that could not be duplicated for two or more thousand; or a dory model runabout which is a prize at six hundred, write us. Conodoguinet Construction Company, Carlisle, Pa.

FOR SALE—A runabout at a bargain. Will be sold to quick purchaser for $1000.00, the second-hand price of her engine alone. She is 24 x 6 x 2. She can jog along at about 16 miles, hour in and hour out, and can give you 20 miles if you need it. A fine "V" bottom runabout with complete inventory. A boat you will be proud of. Address: George Valley, Essex, N. Y.

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Spar Composition
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No. 1 Preservative
Send for Catalogue
The David B. Crockett Co. Bridgeport, Conn.

Is Your Propeller Suited to Your Boat?

(*Continued from page* 40)

high torque, but as the skin friction increases rapidly with increased engine speed, a point is often reached where the skin friction is so great that a narrower blade with less surface area will give better results than a wide blade. Although the apparent slip may be more with the narrower blades the reduction in skin friction more than makes up for the increased slip, and the boat speed will be increased by the change.

From experiments in model basins and with actual installations, the most efficient shape for propeller wheel blades working under normal conditions has been found to be what is known as the oval shape blade. For towing work a blade with the greatest width near the outside end, where it will grip on solid, undisturbed water generally proves the most successful. On fast boats where skin friction is a big factor the narrow oval blade gives the best results.

For special conditions, such as running in water where weeds, eel grass, and other marine growths are near the surface, the propeller, with the blades curved nearly into a semicircle, will cut its way through the vegetable growth without winding it around the shaft. Such wheels, if carefully designed, are nearly as efficient as those with oval blades, but as a general rule the use of such a wheel should be confined to boats continually navigating weed-infested waters.

From time to time various types of wheels have been put on the market with blades of odd shapes, a combination of a large and small diameter propeller, blades with fins on the ends to keep the water from being thrown off in any direction except directly astern, and other novel features, but they do not equal the efficiency of the usual type.

The question of the number of blades is one of the easiest points in propellers to give a definite answer to. A two-bladed wheel is more apt to cause vibration, especially if near the rudder, and should never be used unless the flow of water to the wheel is unobstructed by deadwood, heavy struts, or other structures.

With the size of propellers generally used on motor boats the blades are so close together in a four-bladed wheel that they do not have enough solid water to work in efficiently, so that the practical number of blades is limited to three.

To sum up the requirements for an efficient propeller for a motor boat in as few words as possible the requirements are: as large a wheel as the engine will turn at its rated speed, a pitch that is suitable for the lines of the underbody and the speed of the boat, and a blade width consistent with the speed at which the motor is designed to operate.

Through the Gate

(*Continued from page* 38)

or more out in the channel bucking the full strength of the current.

There are just three things to be careful of. Don't attempt the trip in a thick fog. The most experienced pilots on the river always tie up to a dock till they can see where they are going. Give tows of car floats or large barges a wide berth. When these ungainly craft get in the strong currents they are no longer under control of the tug pilot and often need over half the width of the river. However, as they draw much more water than a motor boat there is no danger of being caught between them and the shore as they will run aground, leaving plenty of water between them and the shore for a small boat. It is only during the worst storms that such conditions are likely to arise.

The third is probably the most important of all. When the tide is running flood (from the East River to the Sound) the current sets in from between Great Mill Rock and Hallet's Point over Hogs Back and any boat too near these rocks is likely to be carried up onto them. In fact, the current is so strong that the momentum of the water actually carries it up hill over the rock.

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Eliminate that waste of power and fuel which is caused by your inefficient propeller. Gear your boat to the water by installing a wheel that produces the maximum driving thrust for the amount of power developed by your engine. Get a

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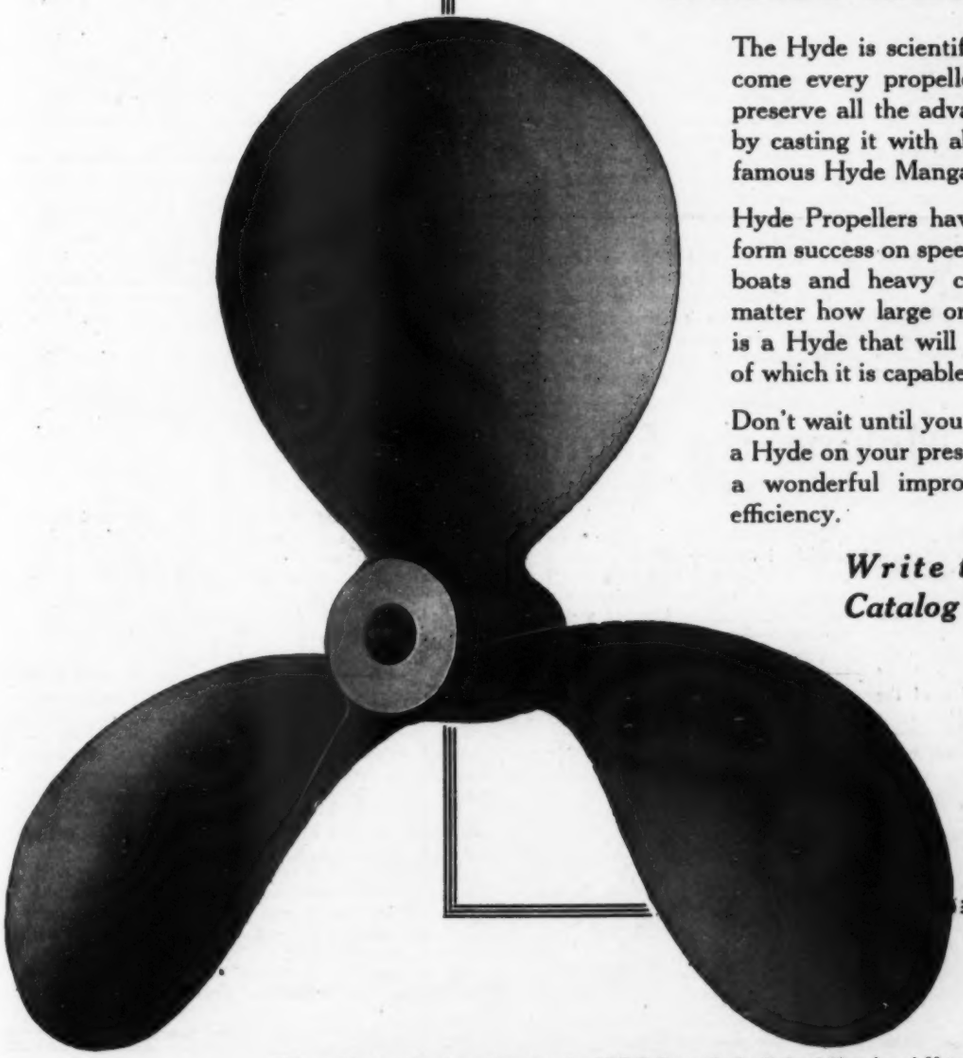
PROPELLER



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HYDE WINDLASS COMPANY

Bath, Maine, U. S. A.

Waterways to Supplant Railways

(*Continued from page 32*)

no statement as to what is contained in these reports until they have been passed on and made public by the Director General of Railroads, but it is hard to see how, in view of the long continued congestion of railway traffic, the report can be otherwise than favorable to the operation of these waterways by the Government. The final decision, of course, rests with Mr. McAdoo.

The Upper Mississippi was first of all the waterways in the country to secure Government funds for the building of boats and barges. Minnesota iron ore is wanted in St. Louis and there is always a market for coal in Minneapolis and St. Paul, so full loads are available in both directions.

During the winter, therefore, the matter was taken up with the Shipping Board, which set apart $3,360,000 with which to build four towboats and twenty-four barges for this coal and iron ore traffic on the upper Mississippi. Contracts have been let for eighteen of the barges and plans and specifications for the towboats are practically completed.

The Chicago Drainage Canal is big enough for ocean vessels and the Illinois River has a channel 8 feet deep. Over the sixty-odd miles which separate the two the only connection is the Illinois and Michigan Canal. This was only 6 feet deep when it was built, some eighty years ago, and in recent years it has been neglected, and in places has become nearly filled with mud. Believing that it would be of some service if restored to its original depth, Representative Henry T. Rainey took the matter up with President Wilson, with the result that $150,000 has been allotted from the President's Emergency Fund with which to do the needed dredging.

It goes without saying that the Committee on Inland Waterways is receiving many requests for Government assistance in the restoration of water transportation in all parts of the country. How many of these will be granted only time can tell. Conditions, due to the war, are such that transportation operations of any magnitude must be carried out either by Government help or by the Government itself. Nevertheless a very large amount of private capital in the aggregate is going into transportation enterprises covering everything from single motor boats to packet lines and fleets of boats and barges for handling the products of mines or industrial plants.

But there is one interesting instance of cooperation between highways and waterways which is worth mentioning before we give the pessimists a chance. Manufacturers of automobiles have a decided advantage over the makers of most other things because their products can be delivered over considerable distances under their own power. It is not desirable, however, to make the distance so great that the cars will practically become second hand before reaching the purchasers.

A manufacturer in Flint, Mich., when the railroads could do nothing for him, solved the problem by driving them to Cincinnati, where they were loaded on barges, taken down the Ohio and Mississippi Rivers and delivered, five days later, at Memphis. Four hundred and fifty machines have already been delivered by this method and more are to follow. The largest shipment sent at one time consisted of 179 autos, which, as will be seen by the illustration, comfortably filled three barges.

On one point the pessimists have genuine grounds for groans, for the cost of conducting water transportation has increased out of all proportion to the returns received. Coal is costing two and three, and sometimes four and five, times as much as formerly, and common negro roustabouts are demanding and getting from $100 to $125 a month, and even at that the supply is nowhere near equal to the demand. A steamboat recently left St. Louis with only sixteen roustabouts. When she should have had thirty. At Cairo two of these deserted, leaving her only fourteen. These demanded and got $120 a month before they would continue on the journey. Because of this shortage of labor it took thirteen days to make a trip that should have been made in ten. These three extra days of time and the price paid for labor probably consumed the entire margin of profit for the round trip.

The pessimists further point out that even with all the talk of car shortage shippers for some reason fail to patronize the boats. It was recently reported that the last one of the St. Louis and Tennessee River packets has laid up for want of freight. A few years ago this trade supported three boats a week, and now one cannot make both ends meet. On the last trip of the last boat only 50 tons of freight in all were handled between St. Louis and the terminus on the Tennessee River. Similar reports come from other parts of the country, including the Columbia River, where the high cost of labor and other expenses and poor patronage have resulted in tying up the boats.

It is further pointed out that, with all he has on his hands, it is impossible for Mr. McAdoo to give personal attention to the recommendations made by the Committee on Inland Waterways. These recommendations, therefore, are turned over to his assistants, all of whom are railroad men, the very class of men who for forty years or more have been using every means, fair or foul, to kill off water transportation. A Washington correspondent of the St. Louis *Post-Dispatch* pointed out that the report of the committee regarding the lower Mississippi River boat and barge line went first to the Assistant Director General, Walker D. Hines, Chairman of the Board of the Louisville and Nashville Railroad; from him to the Regional Director, C. H. Markham, who is President of the Illinois Central, and who appointed a committee of three railroad men to report on the recommendations, which committee consisted of ohn Howe Peyton, president of the Nashville, Chattanooga, and St. Louis Railroad, a controlled property of the Louisville and Nashville; Frank B. Bowes, vice-president of the Illinois Central; and F. C. Reilly, freight manager of the Frisco.

The Louisville and Nashville road has been known for years as perhaps the most implacable enemy of water transportation in the United States, Mr. Peyton is the author of a book which seeks to prove that it is a crime to spend any money on inland waterways, and men connected with the Illinois Central, which parallels the Mississippi for more than a thousand miles, can hardly be expected to become unduly enthusiastic over the creation, by the Government, of a great competing boat and barge line. The *Post-Dispatch* correspondent says "practically all the railroad interests surrounding McAdoo are hostile to making any such use of the Mississippi. Having killed river traffic once they do not want to have to do it again; nor are they sure that the Government would permit them to do so.

The pessimists go still further and declare that, whatever may be done by the Government during the war, it will be impossible for private capital to maintain water transportation when the railroads are again in private hands, unless legislation is enacted to protect the waterlines against unfair railway competition. They declare that it is unfair to allow the railways to make rates so low to river points that the boat lines are driven into bankruptcy, while they recoup themselves for the losses so incurred by charging unduly high rates to points where there is no water competition. There are plenty of instances in which the rates to non-competitive points are from twelve to twenty times as much per ton per mile as is charged to the points where the boats could run.

Making the Camera Talk

(*Continued from page 19*)

of plumb many times per second. The remainder of the recorder is simple: A powerful beam of light is projected through the galvanometer and onto a section of the film which passes by a narrow horizontal slit. In the path of the beam is the wire or string, which, in a greatly magnified form, casts a shadow on the film. The wire is so placed with relation to the film slit that the shadow starts at one end and extends as far over as the distortion of the wire at any given moment. Thus the completed sound record, as shown in the accompanying sample strip of negative film, comprises a series of "peaks" or points with a straight edge as a base, just as in the case of a saw.

Of course the sound record is made at the same time as the motion pictures. A combination camera is employed in which the film, at the rate of twenty pictures instead of the usual sixteen per second, passes first through the motion-picture mechanism and then through the sound recorder. The movement through the motion-picture mechanism is intermittent, while that through the sound-recording member is continuous. It so happens that it is not entirely feasible to place the sound recorder opposite its corresponding image; but the inventor claims that even if a film is damaged and spliced there is no noticeable affect in the synchronism of sound record and pictures, for the reason that the two are quite near together and that the cutting of the film removes a similar amount of sound and photographs, maintaining the rigid balance.

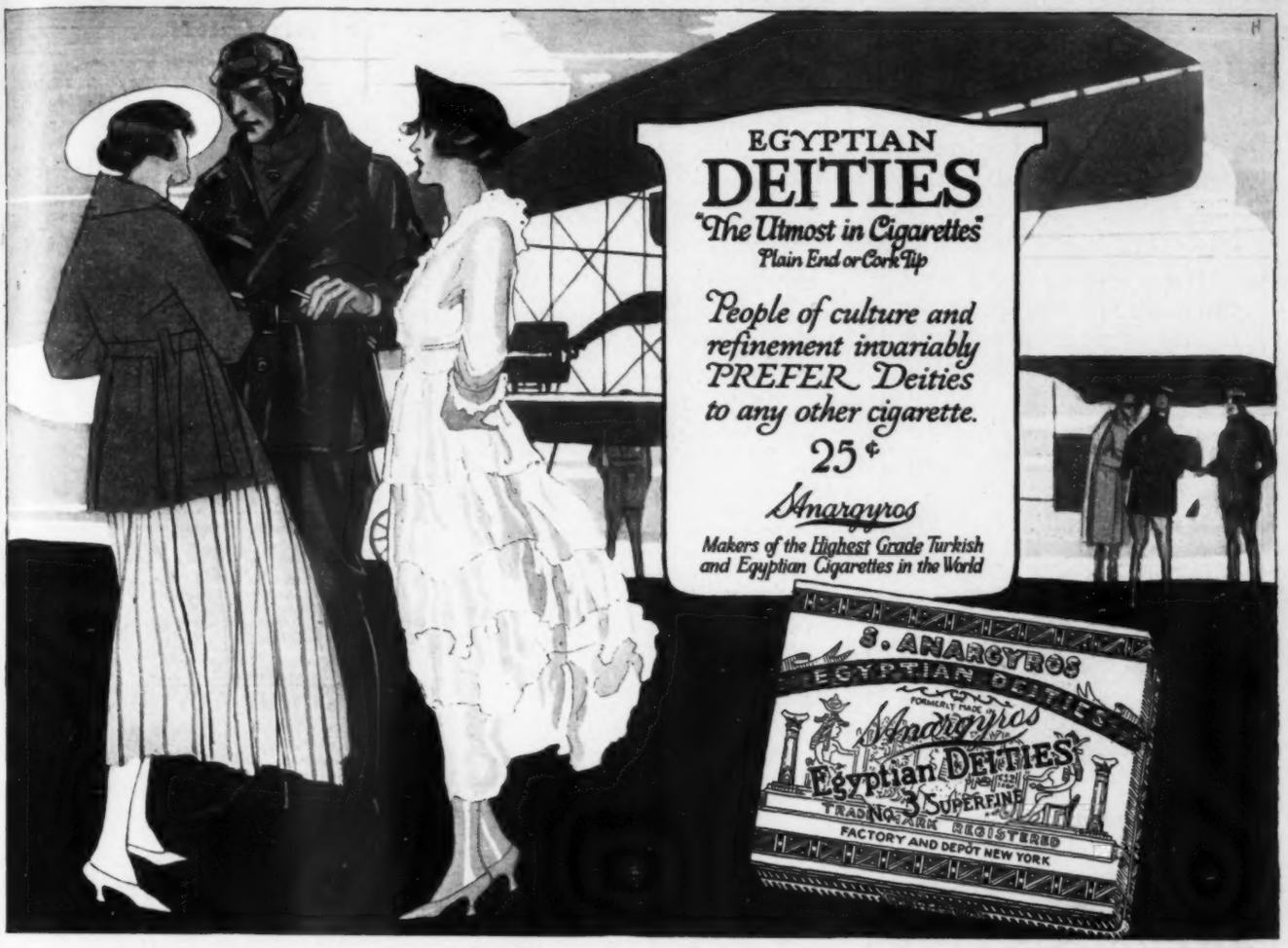
With a film containing the motion-picture images and the sound record, the subject of projection is considered next. Here we find that Mr. Lauste has retained the usual motion-picture projector, through which he first passes his film at the rate of twenty per second in the usual intermittent fashion, and has incorporated in the same machine the special sound-recording apparatus, through which the film passes before it is finally wound on the take-up reel. As in the camera, the movement through the sound recorder is continuous.

The sound recorder consists of nothing more than a powerful beam of light which is passed through a narrow horizontal slit, through the sound-bearing section of the film, and onto a sensitive selenium cell. Selenium is a mineral substance which has the remarkable property of altering its electrical conductivity according to the amount of light falling upon it. In the present instance the selenium cell has a range of resistance of from 1,000 to 100,000 ohms, which is rather exceptional.

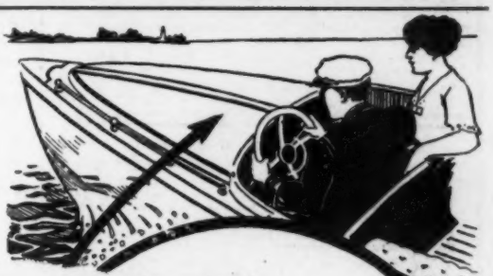
As the selenium is continually subjected to a rapidly changing strength of light, its resistance also changes. As in the cast of the microphones, it varies the strength of a current flowing through it and, in turn, through a delicate relay. The relay controls another circuit in which is placed a loud-speaking telephone based on a new principle. At present Mr. Lauste will only say that his loud-speaking telephone operates on a pneumatic principle, and has remarkable amplifying properties.

While in its present state of development the talking-picture system of Mr. Lauste has been exhibited in England and favorably commented upon by leading motion-picture men, the apparatus is so diversified and intricate that there

(*Continued on page 78*)



Packard Jr. CABLE



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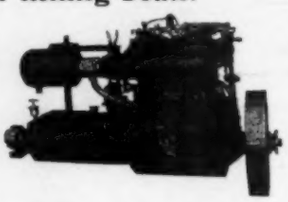

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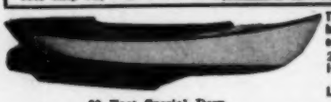
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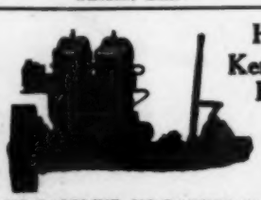
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INGRAM-HATCH MOTOR CO., Inc.
2 & 4 Stone Street New York

First Motor Boat Goes Through the New Barge Canal

(*Continued from page 54*)

likely place to the writer. You soon arrive at your first lift, with the same experience as at other locks, the gate opens, you enter and are quietly and quickly lifted to a new level for a short run to Brewerton.

At 5:30 the next morning we started, with the weather very thick and hazy, but we easily picked up each buoy and soon saw Sylvan Beach Breakwaters, which they say can be a very nasty place on a rough day but to us was very nice, being quite thickly populated.

Leaving the lake, you pass through a new cut straight away to Lock 22, you are again lifted to Lock 21 and here you reach the highest point of your trip. Arriving at Lock 20. you again resume your drops, through 19 and 18, and then arrive at Little Falls. Here you receive a real drop, 40½ feet, but looking at the lock from its lowest, it seems a hundred, and some relief is felt when the gates are open and you can get away from the force of those pent-up waters. Next you enter the beautiful Mohawk River, and seen at this time of the year its beauty is impressive.

Passing through Locks 16-15-14, we planned to make Amsterdam our port for the night. We passed through Locks 13 and 12 after sunset, and arrived at Amsterdam.

After leaving Amsterdam the next stop is Schenectady, where complete supplies may be obtained at the Schenectady Yacht Club.

Leaving Schenectady, a short run brings you to the most beautiful part of the trip, through the Niskayuna Lake. This will make a fine trip for the small boats on the Hudson or New York waters. Any boat that can stand the Hudson or Lower Bay can make this trip in safety. At the end of Niskayuna Lake is Goat Island, seemingly the supporting column for two great spillways. Here you enter Lock 7 with a drop of 27 feet which seems to have been built for a forerunner of what is to come, for in the next three-quarters of an hour you see the fruits of a gigantic engineering enterprise, one following another so closely that the mind does not grasp it in its full magnitude until you have passed.

First, just before reaching these five locks your approach is by a curving channel hewn from solid rock, cliff tops towering over your head 50 to 100 feet in height. You first see an immense gate, then another gate of the same magnitude, then a short distance and there is Lock No. 6. Gates being open, we entered, and before our lines were passed ashore the gate was closed and the lock keeper was asking for our permit. It seems to be the custom at each lock to telephone to the next lock, reporting the passing of each boat, for they always seemed to be waiting for us.

Passing from Lock 6 to 5, then to 4, and so on to 2, making the five locks under one and a half hours. Here we first heard of the sad ending of Anna May. We had been reported as traveling together and thinking we were personal friends, the inspector with great tact and splendid consideration made us acquainted with the tragedy. We were informed that Anna May, one man aboard, had passed through Lock No. 2 at 12:30 A. M., Friday, May 25, and guard at mole at Troy reported hearing a cry for help about 1 A. M., and upon investigation the wreck of a motor boat was seen at the base of the spillway and to all our minds came the realization that such an accident can happen again, under the present conditions of lighting, at the approach to the locks.

This is what the captain of Anna May saw as he approached Lock No. 1 at the end of the mole. Dividing the lock from the spillway is a fixed red light. Place yourself in this position, darkest part of the night, engine noise covering every warning from outside and then see a red light and any boatman can see what happened. He simply put his port light to another supposed port light and passed the mole and was immediately caught by the current caused by the overflow and was dashed to the foot of the dam. We believe such a condition should not be allowed to continue.

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What Is a Ton?

(*Continued from page* 48)

ing and pilotage charges are based on the net registered tons.

In making up the freight charges the shipper is billed in tons, but there are at least three kinds of tons for this purpose, and the shipper pays according to the one that figures the highest. If the freight is heavy he is charged on a basis of 2,240 pounds to the ton, the actual weight of the freight and its packing, crating, etc. If the freight is light but bulky the charge is based on a ton of 40 to 50 cubic feet depending upon the practice of that particular steamship company.

The full, or loaded, draft is determined by what is known as the freeboard markings, or Plimsoll mark on steamships or sailing vessels when they are built in accordance with Lloyd's specifications. These markings are the peculiar hieroglyphics seen on the sides of ocean-going vessels. The top edge of the horizontal bar through the circle is the waterline when the vessel is fully loaded to its safe carrying capacity.

The single horizontal line directly over the circle indicates the statutory deck line, and the freeboard is measured from the top of this line to the center of the circle. The letters L and R on opposite sides of the circle stand for Lloyd's Register.

As fresh water is not as dense as sea water and as a vessel should have more freeboard when liable to encounter storms, the maximum draft under different conditions is indicated by the peculiar shaped mark to the right of the circle. The top of the line indicated by the letters FW is the waterline when the ship is in fresh water and the line marked IS is the waterline when navigating inland seas.

During the summer the actual waterline, when fully loaded and ready for sea, should not be above the line marked S, and during the winter must not be above the line marked W. If the vessel is to sail the North Atlantic Ocean during the winter, when severe storms are apt to be encountered, there should be more freeboard and the line marked WNA is the waterline under these conditions.

It is not to be understood that a vessel must be loaded down to these marks, they indicate the maximum safe loading and should not be exceeded. Ships make many voyages with cargo holds full without bringing the freeboard markings near the actual waterline. It is from these conditions that the saying "loaded down to the Plimsoll mark" originated.

* * *

WHY A POUND WEIGHS MORE AT THE POLE THAN AT THE EQUATOR

(*Continued from page* 61)

tendency to bulge at the equator. As the center of gravity, in the earth, is located at its center and decreases with "the square of the distance," it is obvious that there must be a slightly greater strength of pull (of gravity) at the poles.

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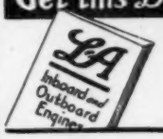

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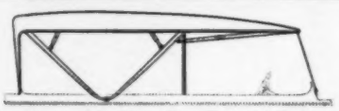

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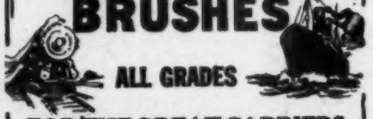

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(*Continued from page 7*)

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Bridgeport, Conn.	H J
New York, N. Y.	*K
Philadelphia, Pa.	L M
Baltimore, Md.	N P
Norfolk, Va.	R S
Wilmington, N. C.	T
Charleston, S. C.	(before numerals) U
Savannah, Ga.	(after numerals) U
Tampa, Fla.	V W
St. Albans, Vt.	X
Ogdensburg, N. Y.	Y
Rochester, N. Y.	Q
Buffalo, N. Y.	Z
Mobile, Ala.	A
New Orleans, La.	B C
Port Arthur, Tex.	D
Galveston, Tex.	E
San Antonio, Tex.	F
Memphis, Tenn.	M
Louisville, Ky.	L
Pittsburgh, Pa.	V
Indianapolis, Ind.	K
St. Louis, Mo.	X
Des Moines, Ia.	H
Omaha, Neb.	Y
St. Paul, Minn.	Z
Pembina, N. D.	J
Great Falls, Mont.	G
Cleveland, Ohio	N
Detroit, Mich.	P R
Chicago, Ill.	S T
Milwaukee, Wis.	W
Duluth, Minn.	U
Los Angeles, Cal.	A
San Francisco, Cal.	B C D E F
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Seattle, Wash.	K L M

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Making the Camera Talk

(*Continued from page 72*)

is almost no end to improvements and refinements here and there. For instance, in a later model the inventor makes use of a double-string galvanometer. In this case the record consists of a double row of "peaks" with the points facing each other; and Mr. Lauste states that this is a material improvement over the single row because it makes the selenium more responsive. With the single row only a portion of the cell is employed, whereas with the double row twice as much area is affected. It follows that the current fluctuation is much greater and more reliable, therefore, with the double-row record.

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Advertising Index will be found on page 104

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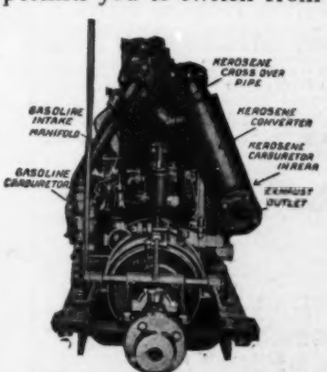

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Free Navigation Schools

(*Continued from page 53*)

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2. Plane Sailing. Traverse. Compass. Leeway. Computation, Inspection and Interpolation. Use of Tables 1, 2, and 44.
3. Parallel and Middle Latitude Sailing. Explanation of Article No. 173 in Bowditch. Use of Tables 1 and 2 for this Sailing Computation.
4. Mercator Sailing. Meridional Parts. Use of Tables 1, 2, and 3 for this Sailing. Computation. Construction of Mercator Chart and its use.
5. Great Circle and Composite Sailing, by Graphic Approximations. Gnomonic Chart and its use.
6. Taking Departure. Day's Run. Other Tables as Nos. 4 and 43, etc.

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6. Use of Tide Tables and other Government Publications. Laws of Storms. Current and Correction. Boat Handling, as Steering, Making Landings, Turning, Action of Propeller, Rudder, Engine-room Signals, etc., Practical Work on the Water.

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2. Time, Astronomical and Civil, Mean and Apparent Solar, Standard. Reckoning Time and obtaining Greenwich Date. Nautical Almanac and how to use it.
3. Corrections to Observed Altitude. Latitude by Meridian Altitude of Sun.
4. Longitude by Time Sight. Azimuth, and Determination of Compass Error and Deviation.
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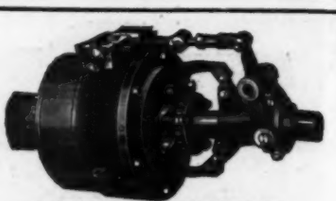

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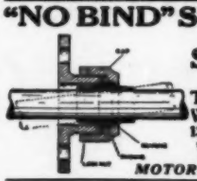

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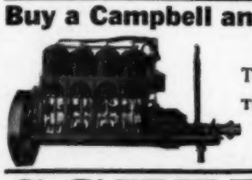

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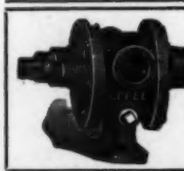

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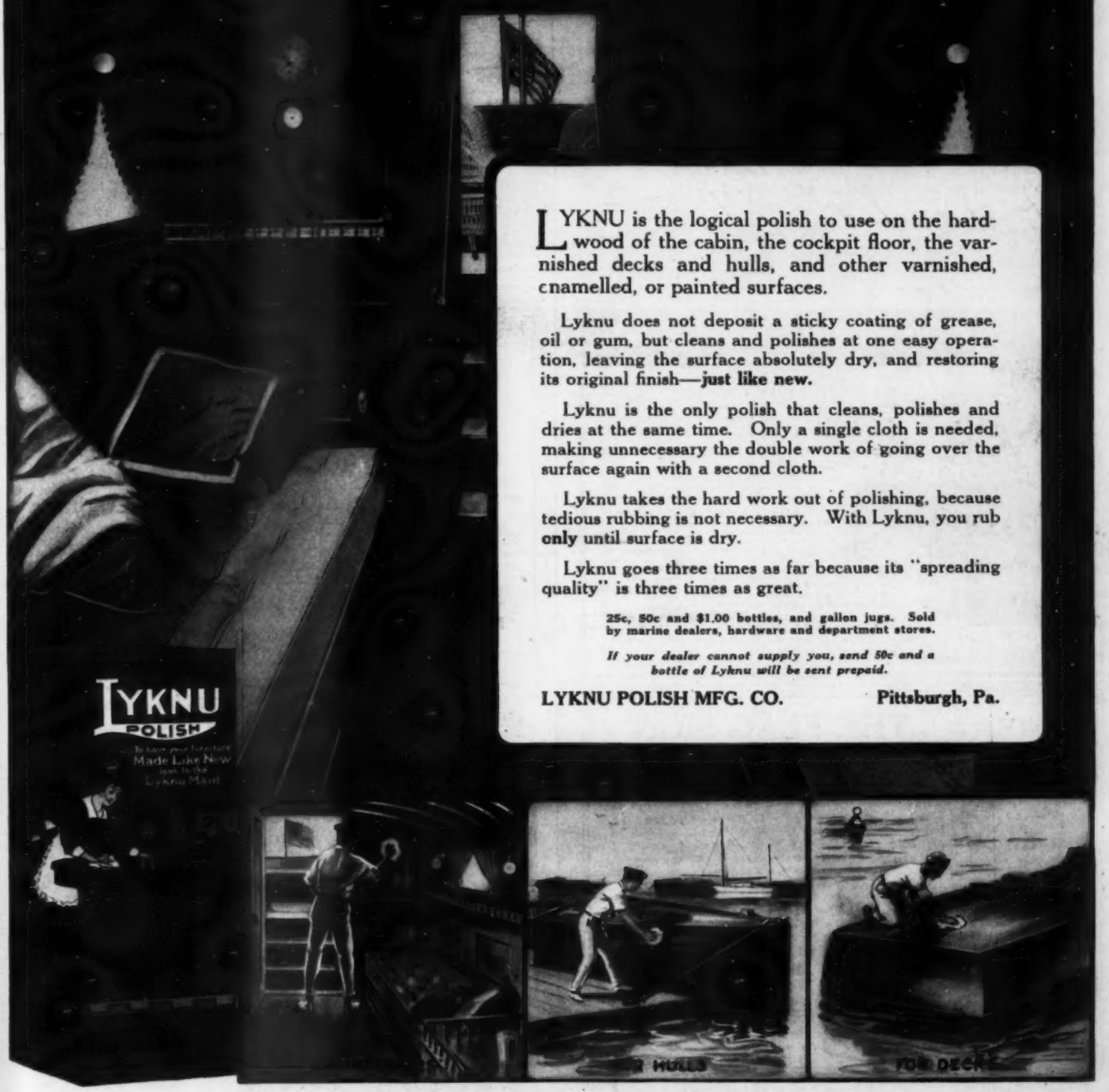

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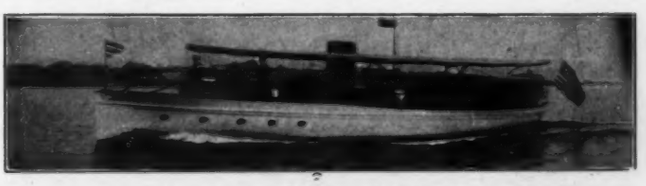

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C. A. WOOLSEY PAINT & COLOR CO., Jersey City, N. J., U. S. A.

Send for our Marine Booklets, Free—Contain Color Spots and information "How to Paint a Boat."

IMPROVED MOTOR BOAT CLOSET

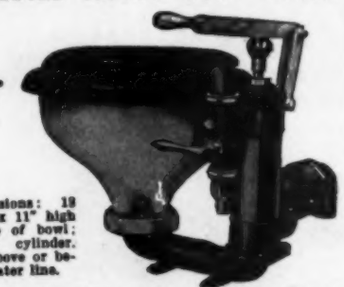


Figure 1404

Dimensions: 18 x 18 x 11" high to top of bowl; 2 ¼" cylinder. For above or below water line.

The best little closet on the market today, possessing many of the advantages of the large size toilet. All brass and porcelain. Oak seat and cover.

All prices subject to market advances, which are continually changing.

Price $25.00

The J. H. Curtiss Co.

Pioneer Specialists in Marine Sanitary Fixtures

Since our advertisement appeared in the first issue of MoToR BoatinG, December, 1907, hundreds of Curtiss fixtures have been installed in motor cruisers and yachts of all sizes, including some of the finest boats launched within this period.

The Curtiss line is exceptionally complete, varied in type, size and price to meet every possible requirement. Each model has been designed in accordance with our wide experience in boat work and can be depended upon in quality, service and durability no matter whether it is our highest or lowest priced model.

With Pump

Lining and Fixtures Nickel-plated. Porcelain Bowl. Mahogany or Quartered Oak Case.

Cock on pump swings upward, thus preventing breaking of bowl. Soap-dish is porcelain and removable.

No. 5
Height, 19 inches.
Width, 19 inches.
Depth Closed, 6 inches.
Quartered Oak Case, Each...$42.50
Mahogany Case, Each..... 44.00

Fig. 1392

THE J. H. CURTISS CO. 2 South Street, New York

HACKER--CRAFT--RUNABOUTS

Serve you on the water, as the Auto does on land

HACKER CRAFT are designed and built under the personal supervision of John L. Hacker, designer of most of America's fast boats, and built by his own Company. They represent his latest work, and have back of them his 20 years of practical experience. They are the utmost in Swift-Luxurious Water Craft.

"FIREFLY-II"—Actual Speed 32.2 Miles. "SEA-PUP-II"—Actual Speed 32.7 Miles.

MOST EFFICIENT 32-FOOTERS EVER PRODUCED.

Guaranteed speed 30 miles with Four Cyl.-100-Sterling

HACKER 26-FOOT SPECIALS

A few of these are still available. Powered with Wisconsin Motors. Speeds from 23 to 25 miles, and delivered as complete as an Auto of the higher class.

Write for particulars today.

JOHN L. HACKER BOAT CO.

323 CRANE AVENUE

DETROIT, MICH.

When writing to advertisers please mention MoToR BoatinG, *the National Magazine of Motor Boating*
Advertising Index will be found on page 104

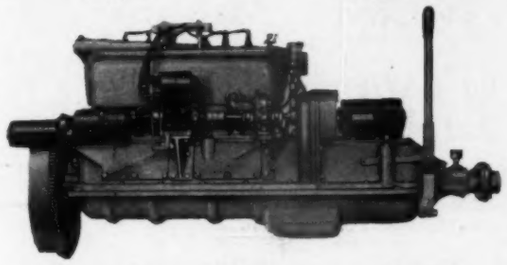
AMERICA'S STANDARD FOUR-CYCLE ENGINE

KERMATH

MARINE ENGINES

12, 16, 20 h.p.

4-Cycle 4-Cylinder



Operates on Kerosene or Petrol

KERMATH engines are built with the care and precision of a watch, every part being balanced for smooth running and control.

The pioneer of 4-cylinder 4-cycle construction

$310 to $555

Where you find a KERMATH engine you find a satisfied owner, no matter what part of the world it may be in.

Care in every department from blending the correct analysis of materials to the assembly has built this reputation; following this same principle for many years has held it.

KERMATH MANUFACTURING COMPANY
DETROIT, MICH., U. S. A.

Scored Cylinders
REPAIRED WITHOUT REGRINDING

Any cylinder that has been scored in service, or which shows small defects in the original casting, can be repaired perfectly at small cost by the

"LAWRENCE PATENT PROCESS"

The Lawrence Process restores a scored cylinder as good as new without regrinding. The original bore is preserved and the standard piston and rings fit as snugly as ever.

Our expert workmen electrically fuse a silver-nickel alloy into the scores or defects without warping or harming the cylinders in any way and then our repair is finished to contour of original bore. **Work guaranteed for the life of motor.**

Our work has been endorsed and approved by all leading engine builders.

Write today to our nearest service plant for full particulars and quotations on your work stating size of cylinder and defect.

L. LAWRENCE & CO.
Established 1862

SERVICE PLANTS

Newark, N. J.....292 Halsey St. Detroit, Mich.....1246 Jefferson Ave.
New York.....546 West 45th St. Cleveland, Ohio.....1810 Prospect Ave.
Chicago.....1457 Michigan Ave. San Francisco, Cal.....116 Hyde St.

Speedway

4, 6 and 8-cylinder marine gasoline engines—the distinctive type—built for those requiring the best.

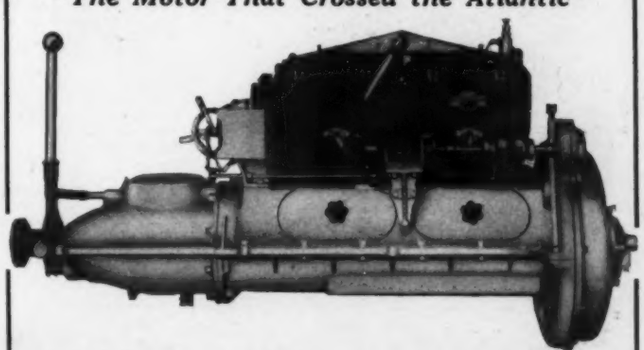
To meet the large demand for the SPEEDWAY engines, we have several models in stock ready for those interested in immediate delivery.

Gas Engine & Power Company and Charles L. Seabury & Co.
Consolidated

Morris Heights New York City

Scripps

"The Motor That Crossed the Atlantic"



Distillate, Kerosene, Gasoline

The SCRIPPS line is unusually complete. It includes power plants for every marine purpose, of every size and type from 10 to 125 H.P.—all four cycle engines in two, four or six cylinders, medium duty or high speed—some using gasoline exclusively, others fitted for burning either gasoline or kerosene.

Catalogs on request.

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631 Lincoln Avenue, Detroit, Michigan, U. S. A.

Which Boat Goes the Fastest and Saves the Most Fuel?

One has a clean, smooth, slippery bottom and is driven at a high rate of speed with the least possible power. The other is heavily penalized with marine growth and a foul bottom—which often costs 50% of its efficiency.

STEARNS-McKAY MFG. CO.
Marblehead, Mass., U. S. A.

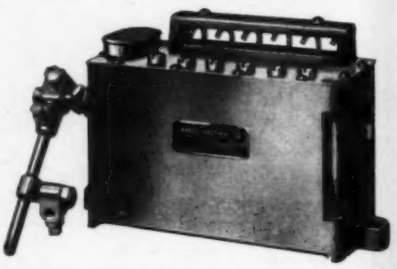
Getting the Most out of Your Engine

You can't expect to get the full quota of power, service and durability out of your engine unless you supply it with a lubricating system which cannot fail under any condition. Remember that a marine engine operates under full load all the time, and that even a momentary failure of lubrication means metal to metal contact of wearing parts which will result in scored cylinders and burned out bearings.

MANZEL FORCE FEED OILERS

pump the oil *under pressure* to each wearing point individually. Nothing is left to chance. As long as you can see oil in the sight glass you know that each part is being properly supplied.

Manzel Oilers not only make complete failure of lubrication impossible but by their uniform measured operation they use the minimum of oil and reduce engine wear to the lowest possible degree.



Made in a complete variety of sizes and styles, from one to fifty feeds. Rotary or Ratchet Drive.

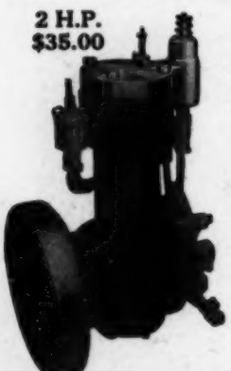
Write today for copy of our free booklet on lubrication.

MANZEL BROTHERS COMPANY
295-297 Babcock Street **Buffalo, New York**

The Dunn Motors of 1918 Models

Can be operated equally well on either kerosene or gasoline

2 H.P.
$35.00



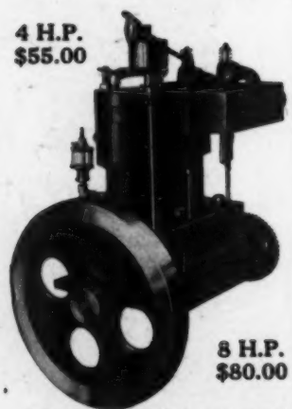
Cut of single cylinder 2 H.P.

6 H.P.
$75.00

12 H.P.
$115.00

Cut of 3 cyl. 6 H.P. motor and cut of 3 cyl. 12 H.P. motor.

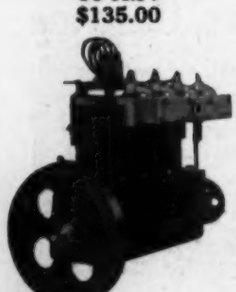
4 H.P.
$55.00



8 H.P.
$80.00

Cut of 2 cyl. 4 H.P. and 2 cyl. 8 H.P.

16 H.P.
$135.00



Cut of 4 cyl. 16 H.P. motor.

Write us for catalogue or, better still, send your order

DUNN MOTOR WORKS, Ogdensburg, N. Y.

The WRIGHT Engine for Your Boat

KEROSENE

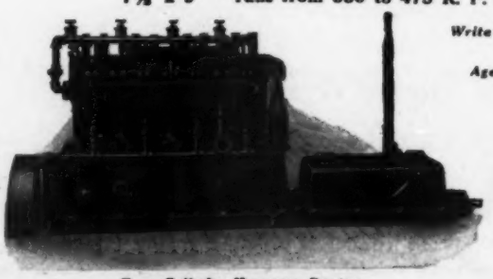
The ultimate solution of the fuel problem. Saves *more than half* of fuel expense, without sacrificing flexibility, power or reliability.

The Wright Kerosene Engine is thoroughly perfected. The kerosene is perfectly *gasified* before it enters the cylinders. It burns clean, free from carbon or lubricating troubles. No smoke or odor in exhaust.

Valves in cylinder heads. Make and break ignition. Bosch Low Tension Magneto

3-Cyl.	6 x 7½"	22-30 H. P.
3-Cyl.	7½ x 9 "	35-45 H. P.
4-Cyl.	6 x 7½"	30-40 H. P.
4-Cyl.	7½ x 9 "	45-60 H. P.
6-Cyl.	6 x 7½"	45-65 H. P.
6-Cyl.	7½ x 9 "	70-90 H. P.

6 x 7½" runs from 400 to 550 R. P. M.
7½ x 9 " runs from 350 to 475 R. P. M.



Four Cylinder Kerosene Engine

Write to-day for full details.

Agents Wanted.

WRIGHT MACHINE COMPANY
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"NORMA" BALL BEARINGS

(Patented)

The ultimate measure of a power boat is in the strength of its weakest—not of its strongest feature. Appearance may deceive, but performance will surely reveal the integrity—or otherwise—of the design, construction and equipment. Let your scrutiny of service qualities extend to every detail of every accessory.

There is a distinguishing mark by which magnetos and lighting generators which deserve your unqualified confidence may be identified. That is the presence of "NORMA" Ball Bearings—the standard bearings adopted by accessory builders to maintain the high quality of their own product.

Be SURE. See that your electrical accessories are "NORMA" equipped.

"NORMA"

THE NORMA COMPANY OF AMERICA

1790 BROADWAY NEW YORK

BALL, ROLLER, THRUST AND COMBINATION BEARINGS

Safety Absolute

The Ever-Warm Safety-Suit

Has saved many lives in U-boat tragedies and has protected thousands through the perils of ocean travel. It did great service in the Tuscania, President Lincoln and other disasters—

You Cannot Drown!
You Cannot Chill!

This great life saving suit will keep you afloat indefinitely, *dry* and *warm*. Put on in less than a minute.

IMPORTANT NOTICE

The thousands of owners and friends of our great life saving suit will be interested in the fact that,—

By a decision just handed down in the United States Circuit Court of Appeals, Judges Rogers, Hough and Hand, the International Life Suit Corporation's rights as the sole agents and distributors for the Ever-Warm Safety-Suit are absolutely established.

For free illustrated booklet, price list and order guide write to

THE INTERNATIONAL LIFE SUIT CORPORATION

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NATIONAL LIFE PRESERVER SUIT CO.
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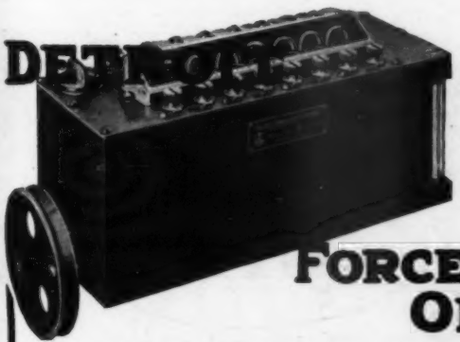

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BUILT BY THE WORLD'S LARGEST MANUFACTURERS OF LUBRICATING DEVICES

Detroit Force Feed Oilers are made in many styles and sizes suitable for every kind of gas, gasoline or oil engine—tractor, truck, marine, stationary, automobile or aeronautic. There is nothing "hit or miss" about these efficient oilers. They are free from complicated mechanism and do not clog up and get out of order. They provide the only safe lubricating system for high grade engines—a positive, reliable force feed.

Every change of engine speed regulates oil feed automatically in exact accordance with need of engine. Positive force feed drives the oil to all frictional surfaces.

Write today for booklet "P."

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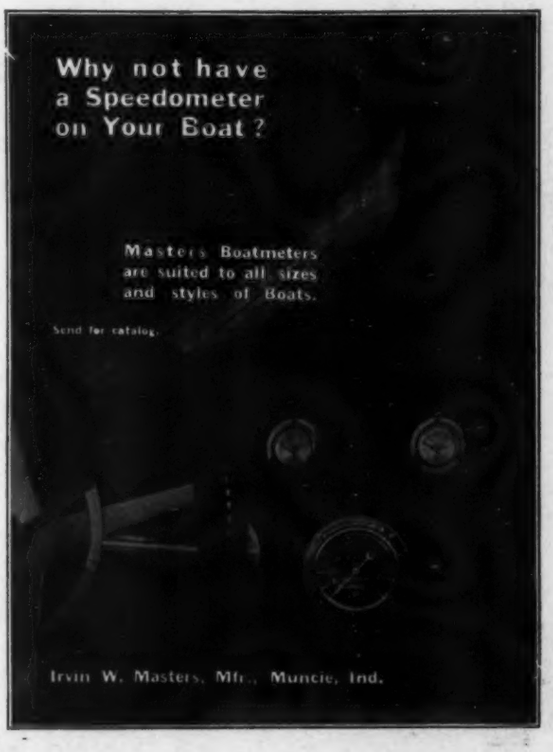
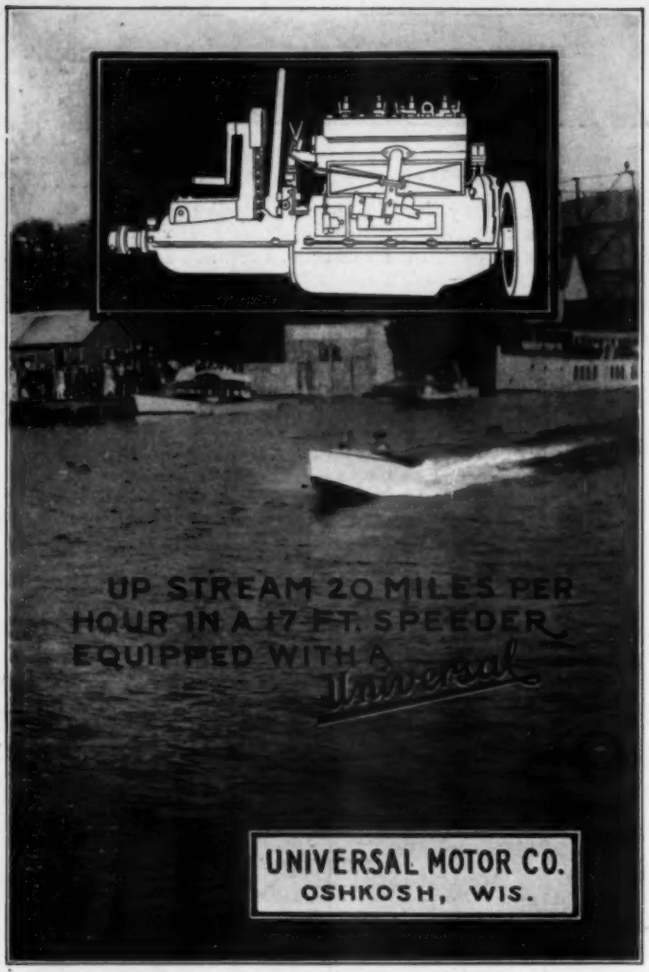
DETROIT, U. S. A.
MAKERS OF STEWART CARBURETORS





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WHEN they come sweeping past the finish line, with the white-water spurting at the bow—that's where the real sport is—and it's easy to get there with an Evinrude.

You can go any place on regatta day—down along the course, past the judge's stand,—if your boat is equipped with the

EVINRUDE
DETACHABLE ROWBOAT & CANOE MOTOR

Just a twist of the flywheel and you are off. Instantly reversible. You can turn around in the length of the boat.

The Evinrude is simplicity itself. Special method of balancing gives wonderfully smooth, vibrationless running. Built-in Flywheel Magneto. Write for catalog and dealer's name.

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Over 90,000 sold. Used by 25 governments.
Also manufacturers of Evinrude Oil Engine.

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POWER

Wisconsin Motors are known for their ability to get maximum power out of every gallon of gasoline. Quiet, smooth running, light and compact, they are the product of the highest type of engineering skill.

Wisconsin Motors
CONSISTENT

for marine use contain those same qualities that have made Wisconsin Racing Motors champions of the world on road and speedway. If it's a Wisconsin it's a consistently dependable motor.

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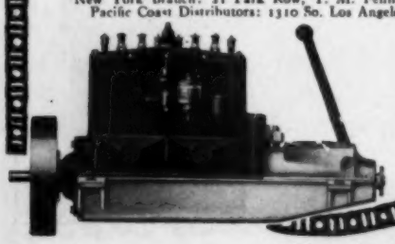
Pacific Coast Distributors: 1310 So. Los Angeles St., Los Angeles, Cal.



Four, six and eight cylinder types. Write for specifications.

Miller

A Common-Sense Motor at a Common-Sense Price

Before you buy a marine motor of any size or type let us tell you about the Miller model best suited to your purpose. Let us explain Miller design and construction, Miller economy and low prices, and Miller service and satisfaction.

Miller Motors are giving extreme satisfaction in every kind of service, the world over. They embody every essential feature for maximum efficiency and reliability. They offer the greatest value for your money because we have adhered to standard construction without wasting money on experimental designs.

Fourteen models, all four-cycle. Medium and heavy duty types. 4 to 65 H.P.

Write today for catalog and prices

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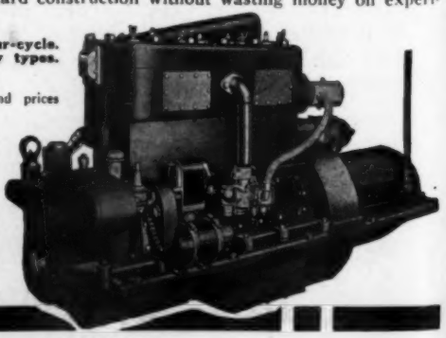

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KEY MODEL
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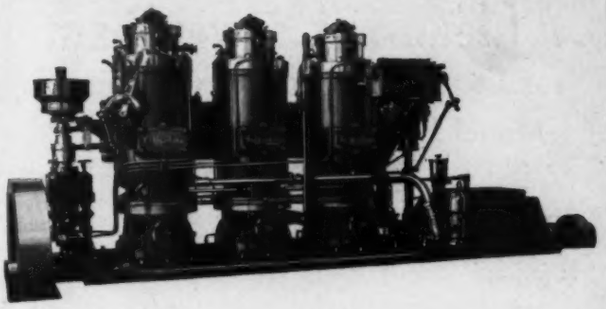
First aid in construction

Made in 28″—36″—48″—72″

COES WRENCH COMPANY
WORCESTER, MASSACHUSETTS U. S. A.
OR YOUR JOBBER

Kahlenberg HEAVY DUTY CRUDE OIL ENGINES



Positive Governor Control from No Load to Full Load. Variable speed instantly obtainable from just "turning over" to wide open.

Operates on any of the crude fuel oils or kerosene.

Absolutely reliable. Fuel consumption .55 lbs per H.P. hours.

SIZES 60 H.P. UPWARDS

KAHLENBERG standard engines in medium and heavy duty types are made in sizes from 2 to 54 H.P. and we would strongly recommend them for operating on KEROSENE, SOLAR OIL and GAS OIL. You ought to know more of the exclusive advantages the KAHLENBERG offers you.

Write for our literature stating your requirements fully.

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WHEN we get through building boats for your Uncle Sam, we hope to turn out a

MATHIS-BUILT HOUSEBOAT

for you. You'll find yourself in good company here. Men like George W. Perkins, Jas. Deering, Murray Guggenheim, A. P. Ordway, L. H. Armour and A. W. Armour must have had pretty good reasons for coming here to have their houseboats built.

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The Automatic MARINE ENGINE

THE AUTOMATIC is the result of years of actual experience in building gas engines for both cruisers and commercial boats. It not only gives reliable power, but does so at minimum expense—whether gasoline, kerosene or producer gas is used as fuel.

It is made to withstand hard work, it is simple in construction, clean and compact. It has bronze bearings throughout, an oiling system that is reliable at all speeds, an enclosed governor, an intake manifold which utilizes low grade fuel.

The Automatic is built in sizes suitable for any boat—little or big. Let us send you complete information.

The Automatic Machine Co.
BRIDGEPORT CONNECTICUT

GRAY-PRIOR
FOUR CYCLE MARINE MOTORS
Built up to a Standard—not down to a price

A Clean-Cut Power Plant
for Commercial Boats and Cruisers
Model D-4, Medium Heavy Duty
36 Horse Power Bore, 4¼ inches Stroke, 8 inches

Quality construction throughout—in design, materials, workmanship, finish and equipment. Exceedingly compact for its power and exceedingly sturdy for its size.

Write today for full description and prices

The Gray & Prior Machine Co.
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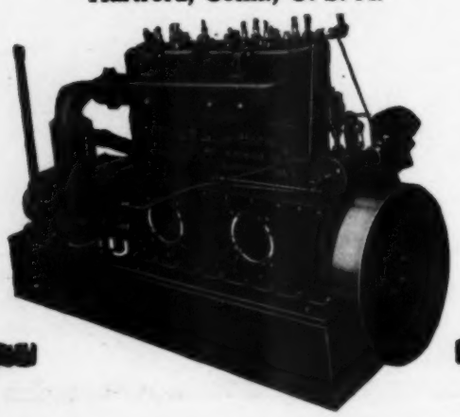


THE GREAT 2-CYLINDER
KOBAN
ROWBOAT MOTOR

The KOBAN is the outboard motor for those who demand real service and freedom from motor troubles.

In every detail of design and construction it is the product of the highest engineering and manufacturing skill.

It has surprising speed, due to the extra power delivered from its two cylinders. The Koban special tilting device makes a hit with fishermen and hunters.

The Koban does not shake the boat. The cylinders fire at the same time, neutralizing the shock. Only by this 2-cylinder opposed construction can you avoid the vibration that makes riding disagreeable, opens seams and ruins rowboats.

The light weight of the Koban, its two cylinder design, its simplicity — make it the best rowboat motor on the market. The Koban delivers maximum power from every gallon of gasoline.

"Towed in 26-ft. launch with twelve passengers and trailer carrying four men." — Grand Rapids, Mich.

The Koban is unexcelled for commercial uses because of its power, speed, reliability and trouble-proof features. It is used by the U. S. Government and in 36 foreign countries.

The Koban proved its dependability by making an 800-mile sea voyage from Seattle to Ketchikan, Alaska, driving a 16-ft. rowboat with two men and loaded with supplies.

Write for illustrated catalog. Dealers and local agents wanted. Write for full particulars.

Koban Manufacturing Co.
246 South Water St.
Milwaukee, Wis., U. S. A.

R. M. Hvid Company
LICENSER OF THE HVID OIL ENGINES
First National Bank Building, :: Chicago, Ill.

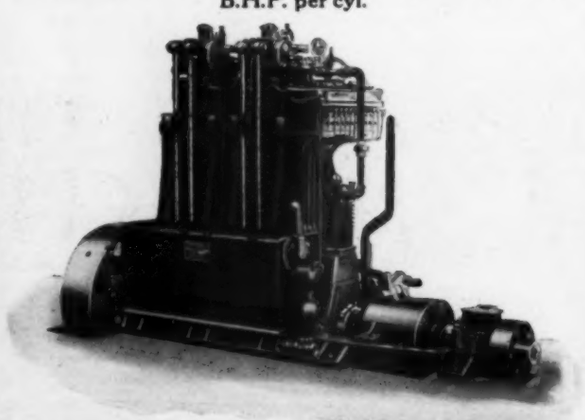
We solicit correspondence regarding license to manufacture engines under patents owned by us.

"HVID ENGINES RUN ON ANY OIL WHICH FLOWS FREELY"

Highest fuel economy. Extreme simplicity.
Absolute reliability in operation.
No preheating or starting on gasoline at any time.
No ignition devices of any kind. No carburetors.

The simplest and most reliable engine built.

Thousands in use now in sizes from 1½ B.H.P. to 100 B.H.P. per cyl.



View showing a 2-cylinder, 20 B.H.P. Hvid Oil Engine as built by the Burnoil Engine Company, South Bend, Ind.

R. M. Hvid Co., First Nat'l Bank Bldg., Chicago, Ill.

BOAT OWNERS Ahoy! YOU Need This BOOK

"SEA Craft Suggestions and Supplies" enlarged edition—216 pages. Full of useful ideas. Tells how to box the Compass and what is proper Ground Tackle; gives hints on Steering Gear, etc. Mailed only on receipt of 25c.

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IT PAYS TO BUY OUR KIND

For 70 years we have been making "DEPENDABLE" Marine Hardware. The mark WC is your safeguard. It stands for QUALITY based upon long experience and skill. Insist upon it.

"NOSLACK" WHEEL
Keeps Your
TILLER ROPE TIGHT

Simple operation takes up all slack. You can use sash cord on your Noslack with perfect success. Meets a long felt want. At your dealer's or write us.

Est. 1847

Makers of Maxim Motor Boat Silencers

WILCOX, CRITTENDEN & COMPANY, INC.
Trade Mark Registered
4 S. Main Street, Middletown, Conn.

King of Marine Carburetors

KINGSTON

THE WORLD'S MOST POPULAR CARBURETOR

This is the carburetor that will give you the highest speed and power of which your engine and boat are capable. And it will do this on the lowest fuel consumption per hour, per horsepower.

The Kingston Carburetor is scientifically designed for modern engines and modern fuel. It is making good and giving extreme satisfaction on every type of marine engine, automobile, tractor, motor cycle or other kind of gas engine. One simple adjustment covers all ranges.

It is the efficiency and popularity of the Kingston Carburetor that has made us the largest carburetor manufacturers in the world.

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Chicago, Ill.: 1430 Michigan Ave.
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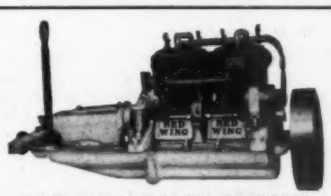

Unit Power Plant Model "F" THOROBRED. 28-35 H.P., 4 1-16 x 5". Furnished with or without Unit Power Plant.

Red Wing Thorobred
THE MOTOR WITH POWER TO SPARE

WHAT IS ECONOMY?

Everyone is practicing economy now, and this justifies an expression on what economy really is. Does it mean to stint and save? Sacrifice? Yes, sacrifice of **useless** things, but NOT the things which produce good health, personal efficiency and happiness.

If you want a motor boat, it is NOT true economy to do without it, because you get so much out of a motor boat in the way of recreation and added efficiency for the whole family it ought to be one of the last things to do without.

The Thorobred is economical in first cost and in operation.

Ask for facts on our four models, from 14 to 40 H. P. They burn gasoline or kerosene.

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Cold Light Mfg. Co., 558 West 158th St., New York
Please send us, without charge, your book on Self-Luminous Radium Compounds.

Name .....
Address M6

Prophets Without Honor

(*Continued from page* 10)

trouble than its pilot breathes the aim of space. Because that source of supply is not from one but thousands of sources, a power failure is unthinkable. The electric motor of today is absolutely reliable. It is noiseless, it is certain, it is light for the power it develops and it is fool-proof.' Give me such a source of power and I will put your railroad trains, your steamship lines, yes, even your automobiles, save for short runs and city use, out of business. And I will make war impossible, because there is and never can be a frontier of the air, and, as Germany, damn her, has demonstrated, the bomb from aloft is as effective against the woman, the child, the church, and the hospital as against the soldier or the munition dump. War would be utterly impossible unless—

"Unless what," The officer looked seriously at the speaker.

"Unless a nation was driven underground and we became a troglodyte world, for fear of the bomb from aloft!

"And the same thing will be true if we harness the molecular force which is everywhere about us, and which we as yet can touch only in radium and a few other substances which are faintly radioactive. Science has demonstrated that there is enough force in a pound of coal to do a certain definite amount of work. We never get that amount of work out of a pound of coal because we lost so much in our wasteful methods of turning the coal into gas, which gives us heat which vaporizes water, which pushes a piston which turns a wheel, which turns a generator which produces electricity. Some one, some day is going to get electricity directly from coal. You may yet see coaling stations for airplanes in which event a few pounds will do all the work that your gas tank does today.

"But I can't speculate on how molecular power is going to come. I only know it is going to come."

During the pause which followed the pilot gathered his wits.

"I can't follow you into the abstract," he began. "I can't follow you as you trace wireless power to its lair, or hunt the force in the molecule. My life is lived in the fumes of a gas engine and bounded by sky above, a joy stick in front and an ever constant lookout for a landing place and the hope I wont break down before I find it. But we do see some things—we of the air—and I can tell you, not what the future holds a hundred years from now, but what the very next step in aviation is going to be—the step which is going to be made with the present day power, the present day motor, even with present day propellers!"

"And that is —?" Enthusiast prodded gently.

"That is the airplane which goes, not slowly, as we speak today of aerial flight, 40 m.p.h., but really slow. Thirty, twenty, fifteen, for all I know right down to zero where the ultimate hovering machine will stand.

"For the hovering machine is the answer to the battleplane. Give me a machine which will stand still in the air and I will not only bomb Berlin off the map, bomb it accurately, scientifically, with neatness and dispatch, but I wont fear a whole squadron of battleplanes. A battleplane must fly fast to fly at all. It is a matter of strike, getaway and strike again. Give me a hovering machine and I will climb so high I am out of sight and hearing, and then I can hover and drop bombs at pleasure. Give me a hovering machine of sufficient power and I can cut off that power, drop like a stone and recover before I strike earth. No battleplane could catch me, unless it, too, was a hovering machine, which isn't likely. For the hovering machine which apparently is going to come into existence from a combination of present designs with a helicopter idea, probably with propellers which are so designed and arranged as to be movable as to their relation with the plane, so that they can drag it up as well as forward is going to be too heavy, too big, to have the speed necessary for battleplane work.

"The other big development which is to come, which must come is silence. I wish I knew how to get it. Of course, I don't, if I did, I'd be a multi-millionaire instead of a pilot and cut coupons and not have half so much fun. We can't muffle an airplane engine without losing more power than we can afford. We can't put back pressure into our high-speed cylinders without choking them. But some day we are going to hit on some scheme to keep our planes silent. Tell me then what is going to save the German city from being wiped off the map? What is going to save the army in the field? What is going to keep us with our silent hovering machines from getting any and every photograph we want? What will restrict us from lying far aloft, like the buzzard, and pouncing down on any enemy craft we see? Nothing. Give me a silent hovering plane and I'll make as much difference in aerial warfare as the present plane has made in land warfare!"

"The boy is right in one thing," added the officer, "the hovering machine will work a revolution in aircraft. But the greatest revolution he hasn't mentioned. It is making the obsolete mobile artillery available again as aerial artillery. Our battleplanes carry machine guns now, and do a lot of damage. We have experimented and with some little success, in heavier guns—some of them shoot both ways at once in order to eliminate the recoil which would otherwise prevent a heavy shooting weapon from being mounted on so flimsy a device as the airplane. But provide us with heavier planes which can hover, which do not depend on speed through the air to stay up, and we'll find the weapon, somehow, even as big as 3 inches—maybe bigger!—which can be mounted on it! Imagine a huge plane, armored, with a battery of 3-inch guns, going after a mass of Huns! After all, the greatest difficulty in present day gunfire is that you can't see what you are shooting at, and must depend on aerial observation to spot your shots and get your brackets. If we could take our guns up in the air and see, with each shot, what we did? Well, I wont say that war, as war would stop, but I'd guarantee to stop my sector of this one!"

(*Continued on page* 96)

Long Life to Your Battery!

Tungar
RECTIFIER

MOTOR starting and boat lighting make up about the hardest service a storage battery has ever been asked to withstand. No wonder lights grow dim, motors won't start. Batteries die young from under charging and neglect.

Every battery needs a **boosting** charge occasionally, a slight overcharge at a low rate to keep the plates in good condition. It isn't safe to adjust your generator for this overcharge—it already charges as fast as the battery can stand.

You can save your battery, and your pocketbook, by using a Tungar Rectifier at least once a month. It is a low price efficient battery charger which operated from any a.c. lighting circuit. There are two sizes for the private boathouse and a larger capacity for the yacht club and repair station.

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General Electric Company

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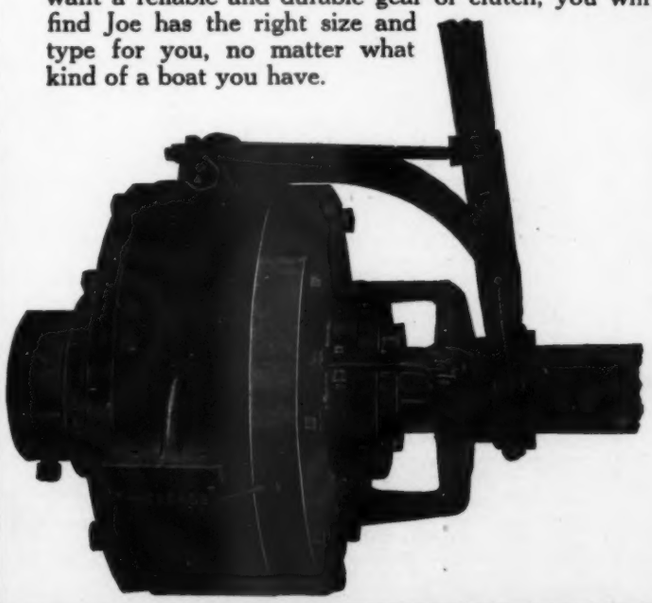
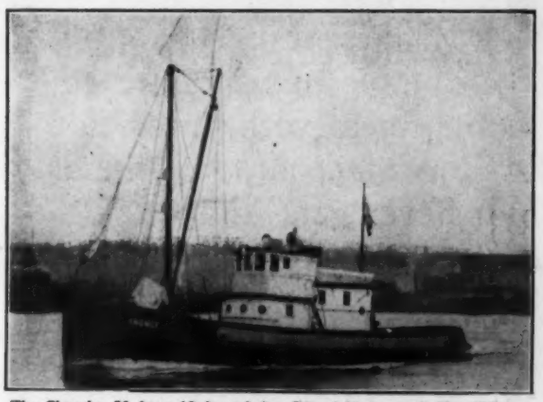
JOES Reverse Gear

You'll find Joes Gears on heavy commercial boats, on big motor yachts and cruisers, on hydroplanes, fast runabouts and pleasure boats of medium size. If you want a reliable and durable gear or clutch, you will find Joe has the right size and type for you, no matter what kind of a boat you have.





The Chomly, 75 ft. x 18 ft. x 8 ft. Diesel Motor with No. 172 Joes Duplex Drive Gear. The engineer took the gear apart after a very long run, then put down in his log, "Some Clutch."

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For Heavy Boats and Racing Craft.
JOES FAMOUS HIGH POWER GEARS
For High and Medium Speed.
JOES HIGH SPEED ONE-WAY CLUTCHES
Especially for Hydroplanes and High Speed Propositions; Smallest Size Transmits 30 H.P. at 1,000 R.P.M.
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Best Made. Absolutely "Kick-proof."

Write today for latest catalog. It contains valuable information you should have before you select any gear, clutch or starter. It is free.

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It has gone to sea with sailors for half a century. It makes ships beautiful, cleanable and durable. Its toughness withstands salt spray and baking sunshine. It never gets sticky.

You will want such a varnish as this for your own craft—one that will last and last and last.

Write for our booklet, "Beautiful Boats and How to Care for Them."

Murphy Varnish Company

Franklin Murphy, jr., President

Newark Chicago

Dougall Varnish Company, Ltd., Montreal
Canadian Associate

ANA

Prophets Without Honor

(*Continued from page* 94)

"I told you I'd convict you all out of your own mouths!" crowed enthusiast. "But none of you have done more than mention the real, the ultimate wonders, which advance in aeronautics will accomplish. We have a small beginning today of airplane mail. We have had a few feeble attempts at passenger service. Within the next twenty-five years, with no revolutionary power discovery, and with merely the improvement of type due to manufacturing and experiment which the physicist has talked about, we will have mailplanes all over the world, trans-Atlantic mails, and trans-Atlantic passengers. One will fly from New York to Chicago in five hours, and back the same day. Europe will be less than a day away. City congestion will lessen, conditions of living improve. Give us a hovering machine, which can come down vertically and land on a house roof, instead of on a long slant and needing a good sized farm to stop it, and you at once fit the plane into our existing complicated stricture of city life. It is the landing and take-off ground which stands between the plane and universal use now. What it will be to aviation in general and daily life in particular when that necessity belongs with the Dead Sea I don't pretend to more than faintly visualize, but it will certainly work a remarkable change. Kipling's 'With the Night Mail' was a wonderful story, but an impossibility when it was published. Verne's 'Twenty Thousand Leagues Under the Sea' never touches the possibilities of the present day submarine. Indeed, good old Jules of sainted boyish memory came much nearer to prophecy in this airplane story than in his under sea classic, for his airplane could hover! But today Kipling's yarn doesn't look impossible or even improbable, and with any luck, all of us who sit here will one day see the plane as much a part of daily life as the motor car, as much a part of war as the motor truck, as much a part of civilization as the city."

The silence lasted only a minute. Then the pilot spoke.

"Well, I've got to take a surface car, a subway, and a taxi to get to the flying field. Then I'll have to see that my men have done their work properly, that my plane is tuned up, that I have plenty of gasoline, that the wind is right on that long field for a quick ascent. Finally I'll scoot over the ground and shoot up into the air. I'll stay there a couple of hours if I'm lucky, and then I'll come down where I went up. If I fly fifty miles away and have to come down, my heart's in my throat unless I see a level field, to land on. If I land in a bog, rough ground or long grass, I'm anchored. If my machine stops aloft, if my gas gives out, if anything breaks, good night! You can't produce your wireless power, power from a stone or a bath, and your hovering plane, any too quick for me!"

There was a general smile.

"Nevertheless, it is coming fast!"

Enthusiast held his ground. And his auditors didn't contradict him. Present scribe not being in the conversation, had no chance to disagree with him. But you, who read what was not intended for your ears, have every chance.

What do you think?

America's Wire Chief

(*Continued from page* 15)

was standing by his side to see that everything went smoothly. The Admiral sped his voice south along the Pacific coast to the Mare Island Navy Yard; dropped a few syllables at San Diego; talked with officers at the delta of the Mississippi; and conferred with the commandants of the Navy yards at Charlestown, Norfolk, Washington, Brooklyn, and Portsmouth. At the Great Lakes he finished his vocal ring around the United States.

His voice next sought the waves of the Atlantic by way of the Arlington Tower. By wireless telephony, he talked with Captain Chandler, commander of New Hampshire, which was then proceeding to sea. When the vessel was fifty miles out and in the midst of a heavy squall the two officers conversed as easily as if they were sitting at the same table.

Colonel Carty was a pioneer when he perfected the metallic circuit, the bridging bell and the common battery. When he needed the right kind of cables and switchboards he made them. While business was going on as usual he changed the installation of the New York Telephone Company twice over. When he made his present connection his first great work was to substitute underground cables for the wires suspended on poles which had previously linked New York, Washington, and Boston. This made communication between those centers independent of snow and sleet.

One of the greatest triumphs of telephone engineering, the carrying of the human voice from New York to San Francisco was achieved in 1914 by Colonel Carty in the opening of the Transcontinental line.

Leadership comes naturally to this executive of the wires because he has made it his life work to develop and inspire others. Owing to the defects of eyesight in early youth, he was not able to take his examinations for entrance to Harvard University as he had planned to do when he was graduated from the Cambridge Latin School. He believed, however, that the best engineering talent could be developed among the graduates of our American colleges and technical schools. Hence he surrounded himself with men of energy and education, who have labored with him to build up a gigantic system.

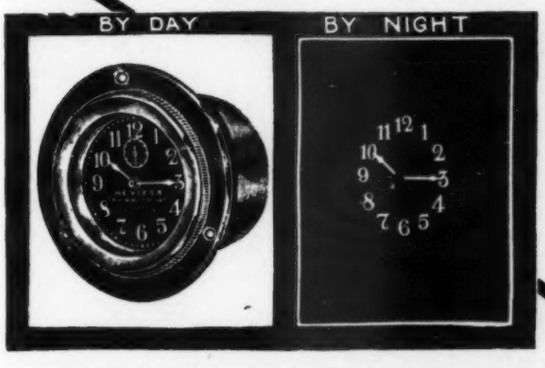
So intent was he in dividing the glory of his great achievements, that his speech accepting the Edison Medal sounded like a continuous disclaimer. It took the combined eloquence of Dr. Alexander Graham Bell and Professor Michael I. Pupin to keep him from shedding all the credit onto the shoulders of his young disciples.

(*Continued on page* 98)

The Ideal Clock for Motor Boats and Airplanes

An accurate timepiece, always in view, is the most convenient and necessary equipment you can have on your motor boat. Install a Keyless Radium Dial Clock on your instrument board or near your wheel and you have the last word of perfection in boat clocks. It is visible every hour of the twenty-four, without any annoying light at night to dazzle your eyes while you are navigating through the darkness.

Radium Dial.
Useful day and night.
Rim-wind—Rim Set.
Runs 8 Days.
Moisture Proof.
Vibration Proof.
High grade movement.
Adopted by the U. S. Navy for Airplanes.



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THOR'S HAMMER
Hurled through the air, Thor's great hammer was invincible. Thousands of men and women under Standard's banner are forging another such weapon.
AIRCRAFT STANDARD
ELIZABETH NEW JERSEY
A Real Fighting Industry
Member of Manufacturers' Aircraft Association, Inc.

The Heavy-Oil Motor

(*Continued from page 37*)

long. She has an ample beam of 20 feet, giving her large freight carrying capacity, about 100 tons when filled.

A 45 h.p. Fairbanks Morse motor, of their new C-O type, furnishes the power for this craft. This engine has three cylinders 8½ x 10 inches, and runs at a normal speed of 400 r.p.m., being held to this speed by a governor. Kerosene torches, cast integrally with the cylinder heads, heat the combustion chambers previous to starting, after which the heat of the cylinder explosions maintain the igniting temperature within the combustion chambers.

Amazon does the distance from Seattle to Tacoma and return, 58 miles, on 26 gallons of Star fuel oil, costing 92 cents, which is surely a very economical showing.

About the time this craft was going into commission the Dickey Bros., out in San Francisco, were changing the steam tug Marie Hanlon over to oil power, installing a 160 h.p., two-cylinder Bolinders engine of the direct reversible type. Marie Hanlon is a tug 71 feet, 5 inches over all, with beams of 17 feet 4½ inches, and draft aft of 8 feet 2 inches. There is food for very serious thought in cost figures prepared by the Dickey Brothers on this installation as they are taken from actual operations. The figures follow:

	Steam	Oil Engine
Horsepower	160	160
Weight per h.p.	450	170
Cost of machinery installed (oil burning)	$13,500	$11,500

Fuel

Fuel burned per day of 19 hours, "steam," 10 barrels oil, at 80 cents per barrel; oil engine, 137 gallons, or 3.26 barrels, at 85 cents per barrel.

	Steam	Oil Engine
Cost of 1 day's fuel	$8.00	$2.77
Cost of 30 days' fuel	240.00	83.10
Cost of engine repairs per month	30.00	15.00
Cost of boiler repairs per month	20.00	....

Engine-Room Crew Per Month

	Steam	Oil Engine
Engineer	$125.00	$125.00
Fireman	65.00	.....
Total engine-room wages per month	190.00	125.00
Total fuel and wages in engine-room per month.	430.00	208.10
Total fuel and labor per year	5,160.00	2,497.20

In the foregoing account of the smaller vessels pioneering the way in the heavy oil field, I have made no mention of the constantly increasing interest being taken in this type of marine propulsion by marine men who were interested in ships of the largest types, either as owners or as prospective builders. They were watching keenly, and when the great war came, and far-sighted business men saw the dawning demand for ocean tonnage, they immediately became feverishly busy placing orders for Diesel engines or semi-Diesel engines wherever they could get even remote delivery.

Forging Uncle Sam's Armor

(*Continued from page 17*)

ment, by which time the surface to a depth as far as the carbon has penetrated has become of glass-like hardness, this process is discontinued.

To subject the plate to further treatment would be futile as well as injurious, because the whole secret in plate manufacture is to obtain a hard surface with the correct backing of relatively soft material. In the right combination the plate is not liable to crack under the impact of a shell, because of the soft material in the rear.

The hardening processes naturally cause some distortion in the armor plates, and since hardened steel cannot be machined with the regular run of machine tools, such corrections as are necessary must be made with grinding wheels.

The armor plates are now ready to be shipped to the navy yards where they are first fitted together in the shops in order to make such slight alterations as may be required, after which they are bolted in place on the descendents of the Monitor and the Merrimac.

At normal battle ranges, say 12,000 to 15,000 yards at which naval engagements are now fought, an armor-piercing shell will penetrate the thickness of its caliber; that is to say, a 6-inch shell will penetrate 6 inches of armor plate, a 12-inch shell 12 inches of armor plate, and so on.

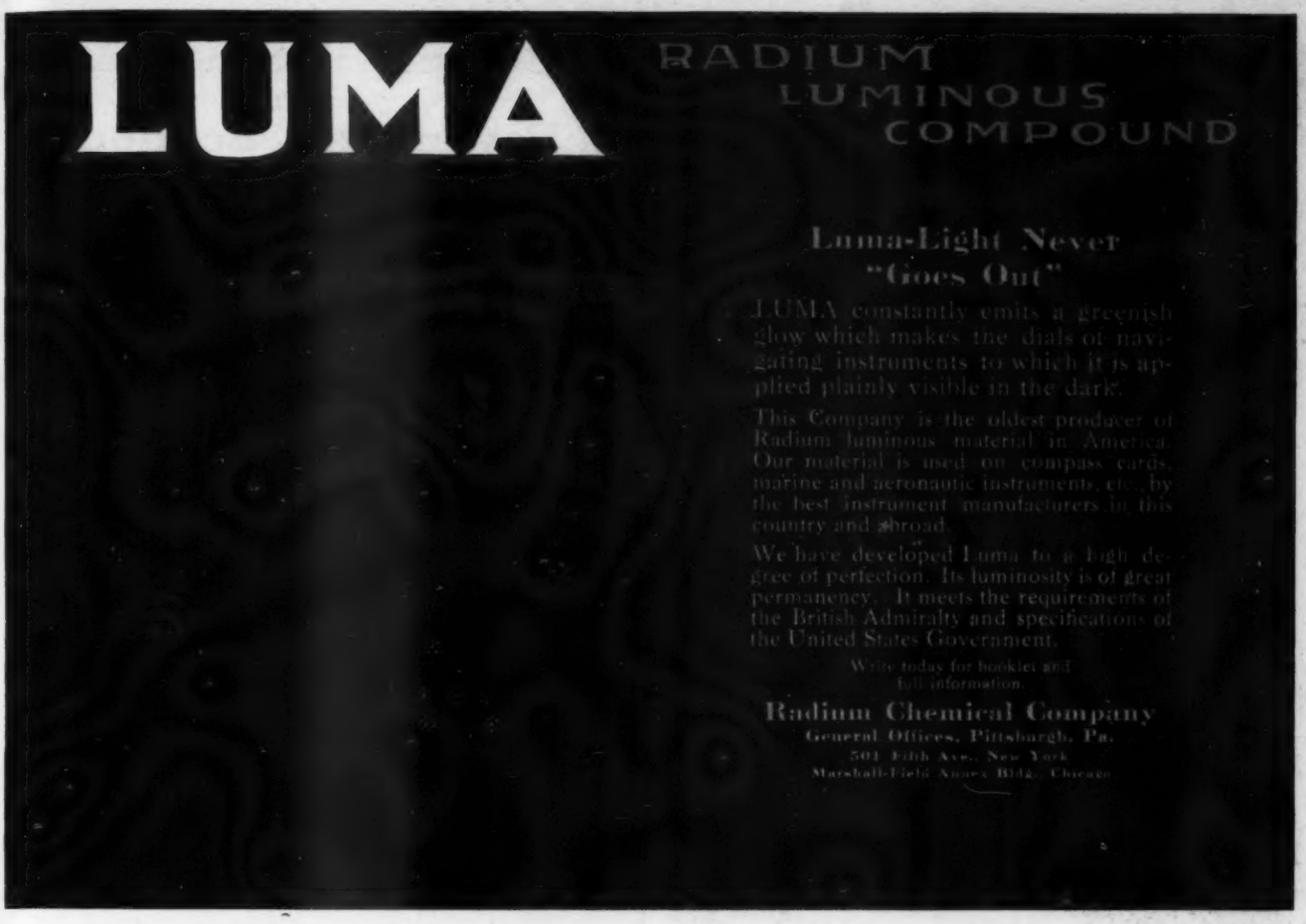
America's Wire Chief

(*Continued from page 96*)

The Edison Gold Medal was founded in 1904 by the Edison Medal Association which is composed of associates and friends of Thomas A. Edison. It is awarded annually by the American Institute of Electrical Engineers which appoints a committee to decide who shall be the recipient. The first award was made in 1908 to Elihu Thomson. Other practical scientists who have been so honored are Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, and Nikola Tesla.

Colonel Carty has other medals as well, such as the one named for Edward Longstreth and the Franklin Medal which is bestowed "in recognition of his distinguished service to mankind rendered in the field of science." Both medals were awarded by the Franklin Institute, of Philadelphia.

In recognition of his work in developing the telephone system of Japan, Colonel Carty was decorated by the Mikado with the Imperial Order of the Rising Sun and also with the Imperial Order of the Sacred Treasure of the Meiji.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When the HARRIS KEROSENE engine was introduced last year, the entire production of the plant, at that time, was contracted for by one of the largest exporters in this country and there has been constant shipments going abroad ever since.

With increased capacity we are in position to accept orders for domestic delivery.

HARRIS engines have plenty of power, developed smoothly and noiselessly, and transmitted completely into propelling force. They are economical, safe and speedy. Built for long service life. If you install a HARRIS in your boat there will be no delays.

Tell us your requirements. Write for literature. State boat dimensions.

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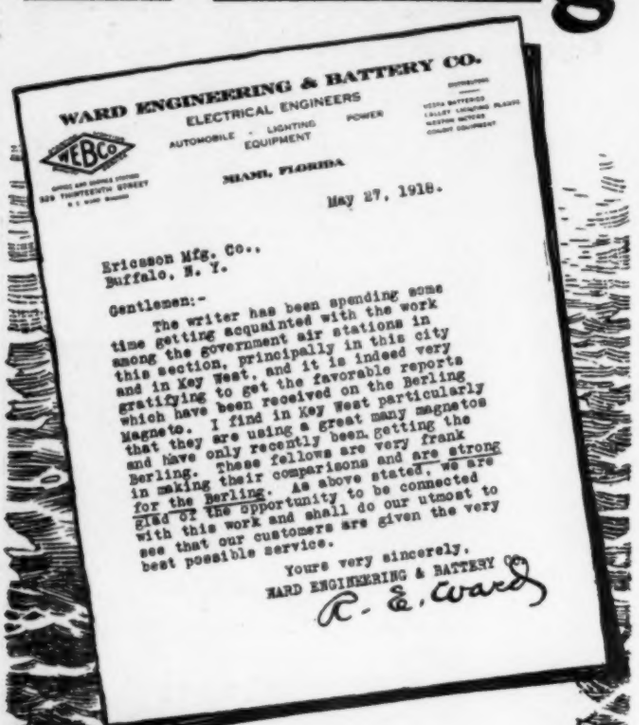
Air men "are strong for the Berling"



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ELECTRICAL ENGINEERS
AUTOMOBILE - LIGHTING - POWER
EQUIPMENT

MIAMI, FLORIDA

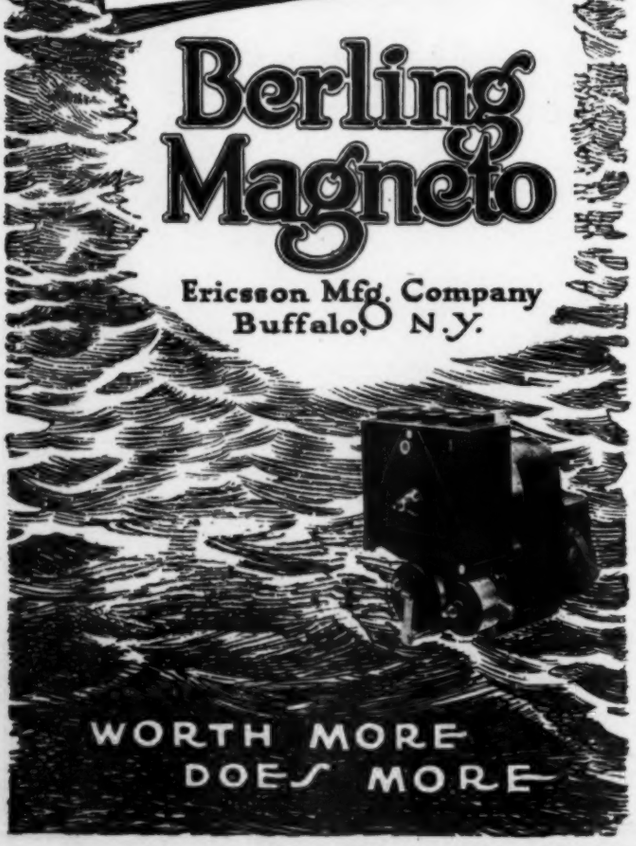
May 27, 1918.

Ericsson Mfg. Co.,
Buffalo, N. Y.

Gentlemen:-

The writer has been spending some time getting acquainted with the work among the government air stations in this section, principally in this city and in Key West, and it is indeed very gratifying to get the favorable reports which have been received on the Berling Magneto. I find in Key West particularly that they are using a great many magnetos and have only recently been getting the Berling. These fellows are very frank in making their comparisons and are strong for the Berling. As above stated, we are glad of the opportunity to be connected with this work and shall do our utmost to see that our customers are given the very best possible service.

Yours very sincerely,
WARD ENGINEERING & BATTERY CO.
R. E. Ward



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Power and Economy

Piston ring leakage may seem trifling in a single motor revolution, but when the leakage is multiplied by a great number of revolutions per minute, it is something to reckon with. It needs correction as much as would a leak in the gasoline tank. That's why it pays to put in the best piston rings obtainable.
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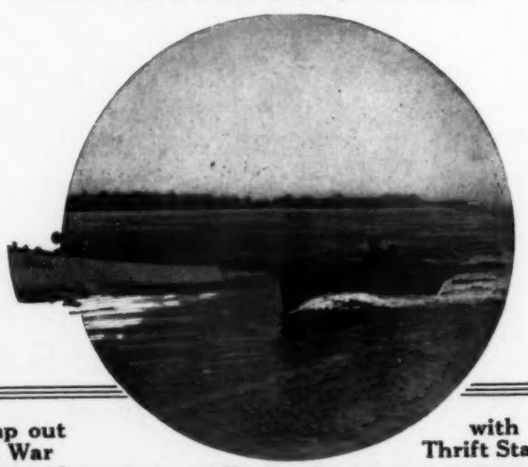

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LONG ISLAND SOUND

Clason Point, Bronx	C. F. Quinn
City Island, N. Y.	Robert Jacobs, A. Malakoff, B. F. Wood, A. Larson
New Rochelle, N. Y.	C. J. Lechler
Mamaroneck, N. Y.	Daniel Forese
Port Chester, N. Y.	J. Kapp
College Point, L. I.	W. Needham, H. Kramer
Port Washington, L. I.	Lewis Bros., Manhasset Bay Yct. Club, H. Berg
Glenwood Landing, L. I.	Jas. Fyfe
Huntington, L. I.	Charles Rosselle
Cold Spring Harbor, L. I.	E. Abrams & Son
Port Jefferson, L. I.	Bayles Shipyard, Inc.
Greenport, L. I.	W. W. Griffin
Fishers Island, L. I.	E. M. & W. Ferguson, A. H. Eldredge
Shelter Island, N. Y.	N. P. Dickerson

CONNECTICUT

Greenwich	So. Norwalk	Stamford
Rowayton	Stony Creek	Bridgeport
New Haven	Noank	New London
Groton	Stonington	Mystic
		West Mystic

LONG ISLAND—SOUTH SHORE

Sheepshead Bay	Edward Berglund
Rockaway Point	P. H. Reid
Canarsie	Sutter Marine Eqt. Co.
West Sayville	F. Ockers
Patchogue	W. R. Marran
Sag Harbor	John Murphy
Montauk	E. B. Tuthill
Freeport, L. I.	J. Carcich
East Rockaway, L. I.	S. S. Rhame
Amityville, L. I.	W. J. Ketcham
Bayshore, L. I.	T. F. Muncey & Son.

HUDSON RIVER

Ft. W. 90th St., N. Y. City	F. R. Welch	
W. 140th St. N. Y. City	F. R. Welch	
Yonkers	S. O. Co. of N. Y., Corinthian Yacht Club, E. E. Hecht at Germania Yacht Club	
Tarrytown	Tarrytown Boat Club, Tarrytown Yacht Club	
Nyack	New Hamburg	Catskill
Grand View	Poughkeepsie	Hudson
Highland Falls	Hyde Park	Coeymans
Cornwall	Kingston	Albany
Newburgh	Saugerties	
Green Island	S. O. Co. of New York	
Van Rensselaer Island Ck.	Capt. Godfrey Smith	

NEW YORK STATE

Greenwood Lake	Orange Co. New York
Auburn	on Owasco Lake
Skaneateles	on Skaneateles Lake

NEW YORK STATE—(Continued)

Cayuga, Ithaca, Watkins	on Cayuga Lake
Geneva	on Seneca Lake
Penn Yan	on Keuka Lake
South Bay, Sylvan Beach, Constantia, Bernhard's Bay, Cleveland	on Oneida Lake

ERIE CANAL

Rome	Utica	Syracuse
Rochester	Middleport	Lockport
Schenectady	Buffalo	Medina
Tonawanda	Albion	Brockport
	Little Falls	

LAKE ERIE

Buffalo	Dunkirk

OSWEGO CANAL

Fulton

NIAGARA RIVER

Buffalo (Foot Erie Street)

Tonawanda — No. Tonawanda

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Sodus Point	Point Pleasant	Charlotte
Sea Breeze	Manitou Beach	Oswego
Sacket Harbor	Henderson Harbor	

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Long Lake	Cleverdale	Kaatskill Bay
Inlet	Eagle Bay	

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Westport	Ticonderoga	Whitehall
Port Henry	Essex	South Hero, Vt
Vergennes, Vt.	St. Albans Bay, Vt.	Isle La Motte
Alburg Spgs.	Alburg	Station
Maquam Bay	Maquam	Highgate Spgs.

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Providence	Block Island	Oakland Bch.
	Point Judith Beachway	

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Dorchester	Woods Hole	Gloucester
Wellfleet		

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Portland	Kennebunkport	Rockland
Bath	Belfast	Eastport
Bar Habror	Boothbay Harbor	

MAINE

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Atlantic	A. C. Smith, E. R. Spurling
Bailey's Island	E. E. Sennett
Bar Harbor	Fifield & Joy
Bass Harbor	Wm. Underwood Co., Watson & Thurston, A. D. Moore
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Beals	C. H. Beals
Bernard	Guy H. Parker
Bernard	Benjamin Murphy
Bernard	Willis Watson
Brooklin	A. E. Farnsworth, J. H. Hooper, G. F. Gott
Camden	P. G. Willey & Co.
Castine	Wardell's Garage
Castine	W. H. Hoopey
Christmas Cove	W. P. Macfarland
Corea	Roy S. Stewart
Cranberry Isles	C. E. Spurling
Cranberry Isles	W. D. Stanley
Cundy's Harbor	A. J. Harris
Dar Harbor	H. C. Pendleton
E. Boothbay	F. L. Rice Motor Co.
Frenchboro	F. W. Foss
Friendship	Jameson & Wotten
Isle au Haut	J. T. Conley
Isleford	Walter Hadlock
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Jonesport (West)	F. P. Smith & Co.
Jonesport (West)	J. W. Lamson
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Jonesport	The Mansfield Co.
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Manset	B. H. Mayo
Manset	J. L. Stanley & Son
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Matinicus	Henry Young & Co.
McKinley	Cunningham & Thompson
Medomak	M. A. Simmons
Monhegan Island	D. M. Davis
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Northeast Harbor	W. G. & L. F. Stanley
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North Haven	W. S. Hopkins
Orrs Island	S. J. Prince & Son
Owls Head	M. T. Jameson & Son
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Pemaquid Beach	Geo. R. McLean
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Prospect Harbor	E. A. Over, J. W. Stinson & Son
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Rockland	S. O. Co. of New York
Rockland	Witham Bros.
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Seal Harbor	Seal Harbor Fish Co.
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South Blue Hill	F. B. Sylvester
South Freeport	L. A. Dickson
Southport	Ralph Thompson
Southwest Harbor	A. E. Parker
Southwest Harbor	S. H. Mayo
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Starboard Creek	Allen & Co.
Stonington	F. C. Dean, S. O. Co. of New York, T Warren
Swans Island	Great Eastern Fisheries Co., S. Morse & Son, W. A. Stanley
Tenant's Harbor	C. E. Wheeler
Thomaston	Dunn & Elliott
Tremont (West)	F. W. Lunt
Vinalhaven	Sanborn & Arey
West Small Point	H. Smith

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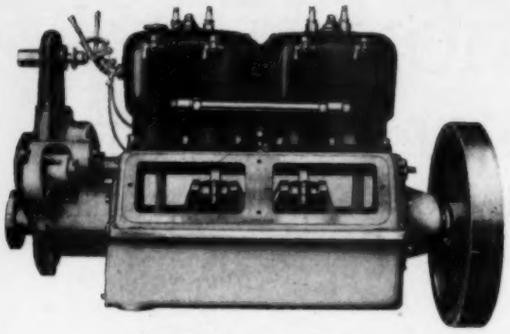
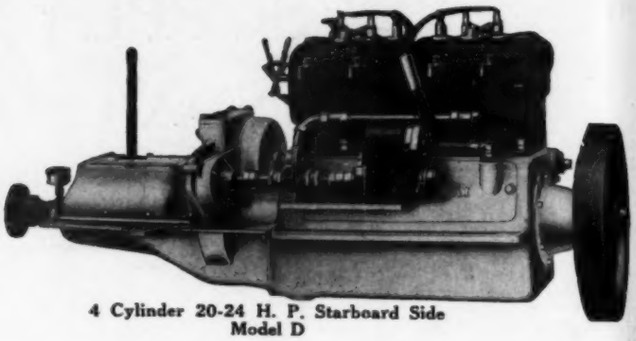


Port Side without Reverse Gear showing accessibility Model D



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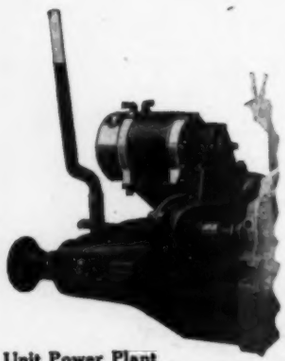

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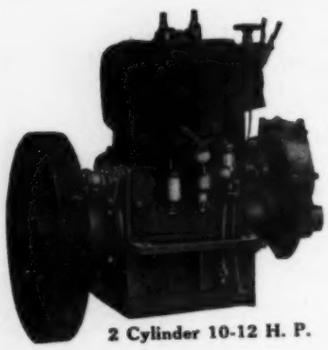

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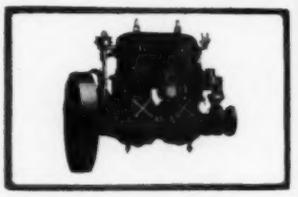

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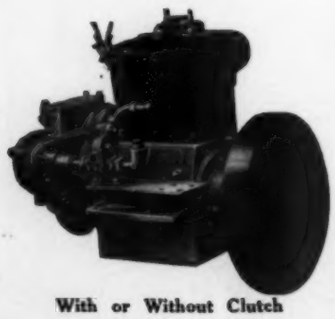

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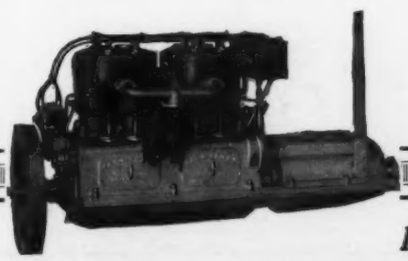

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